The Electrical Industry's Weekly Magazine

March 3, 1958

# Electrical World

Price 50 Cents

A McGraw-Hill Publication

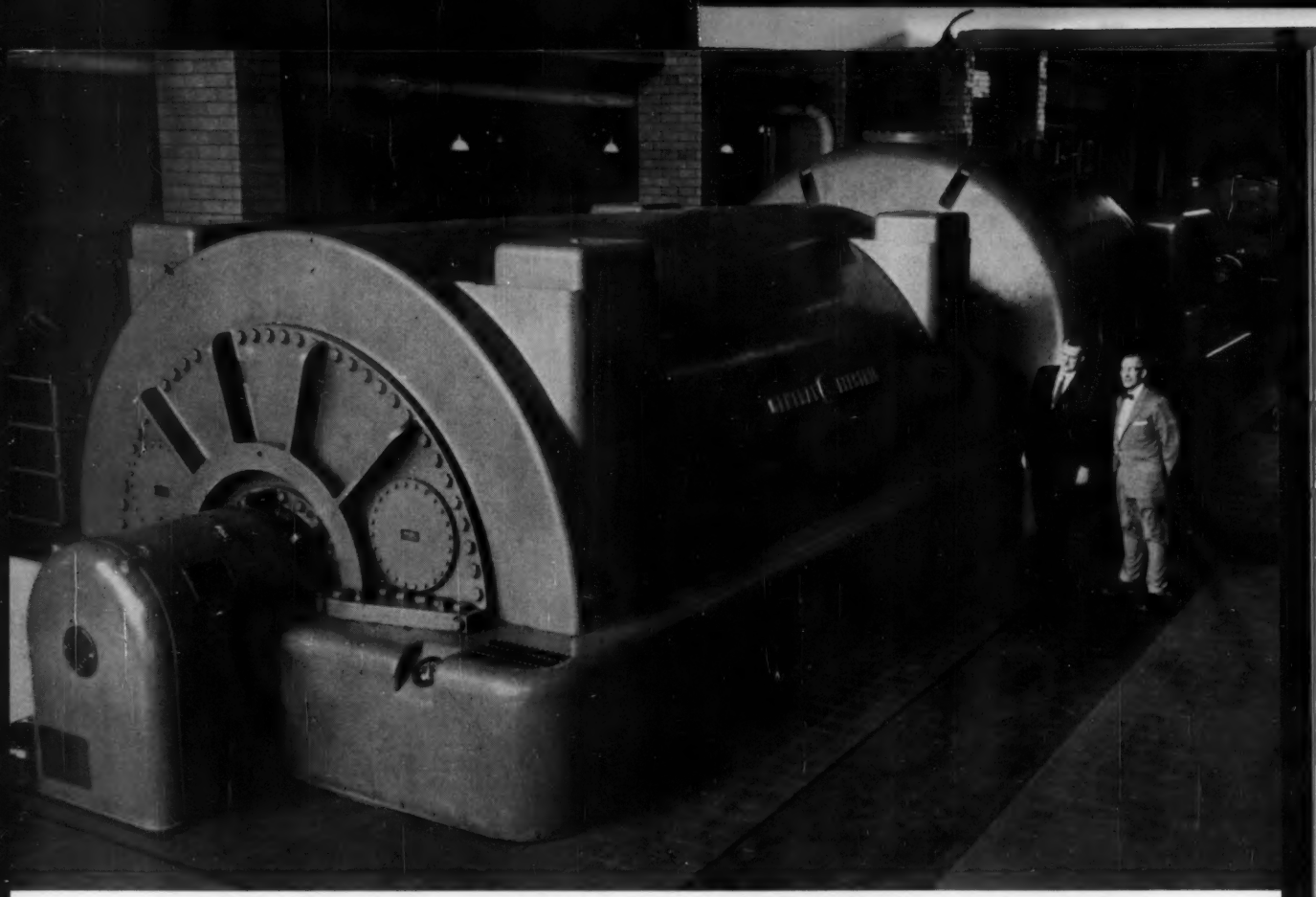
# AIEE WINTER GENERAL MEETING

PAGES 71-82

AT UTILITY BUYERS' CONFERENCE:

How to Cut Costs . . . Page 64

E B POWER GS W 1
UNIVERSITY MICROFILMS IN
313 N 1 ST
ANN ARBOR MICH



This new 70,000 kw reheat turbine—like all other turbines in this plant—is 100% Texaco-lubricated to keep it free from rust, sludge and foam.

## A large Eastern Utility found:

# Texaco gives these 3 big benefits for complete turbine protection:

**1. Unquestionable dependability.** Texaco Regal Oil R&O keeps the utility's turbine system clean; prevents rust, sludge and foam from forming; keeps bearing temperature normal and governor response instantaneous. Texaco dependability is a *fact* for this utility, based on long experience.

**2. High efficiency.** Texaco Regal Oil R&O assures smooth performance and freedom from unscheduled outages. Texaco Regal Oil R&O gives bearings full protection throughout an extra-long oil service life.

**3. Technical service.** Texaco offers this important benefit at a time when power demands are almost out-growing turbine production. Past experience in the power plants has proved Texaco Lubrication Engineering Service to be quick and reliable. This service is always available to Texaco customers—whatever the need.

There is a complete line of Texaco Regal Oils R&O to meet the requirements of all leading turbine manufacturers, regardless of turbine type or size. Let a Texaco lubrication expert help you select the Texaco Regal Oil R&O that will keep turbine efficiency high and maintenance costs at a minimum. Just call the nearest of the more than 2,000 Texaco Distributing Plants in the 48 States—or write:

The Texas Company, 135 East 42nd Street, New York 17, New York.

**TUNE IN**... Metropolitan Opera Radio Broadcasts Every Saturday Afternoon

LUBRICATION IS A MAJOR FACTOR IN COST CONTROL

(PARTS, INVENTORY, PRODUCTION, DOWNTIME, MAINTENANCE)

# Electrical World

Vol. 149, No. 9 MARCH 3, 1958

Published for 84 years for those engaged in the business of generating, transmitting, distributing, or applying electric power

## In This Week's Issue

CURRENT EVENTS

### How U. S. Atom Policy Is Shaping Up

Annual Congressional Hearings on A-power policy provide an insight on what to expect in the years ahead.....p 67

### Buyers Hear: How to Cut Costs

Purchasing agents and manufacturers' representatives exchange views at mid-winter Utility Buyers' conference....p 64

### Utilities' Net Income Rose 6% in 1957

South Atlantic region leads in EW's survey of ninety electric companies. Outlook is for 7% gain in 1958.....p 113

## A Staff Report

### Highlights of AIEE Technical Sessions

In this 12-page report, Electrical World offers items of top interest gleaned from some 400 papers presented at 100 technical sessions and symposiums at the recent Winter General Meeting in New York. This coverage is divided into seven general areas: distribution, cable, transmission, substations, relays, generation and industrial. The general session was reported in an earlier issue.....p 73

## Departments

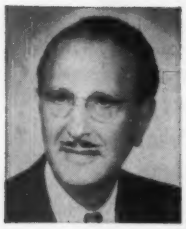
Atomic Progress ..... 67
Books .....122
Editorials ..... 63
• Electrical Newsletter ..... 19
Executive Reader ..... 22
From the Publisher ..... 5
Heating & Cooling.....102
How To ..... 89
• Management Newsletter ...113
Manufacturers and Markets.124
Meetings Calendar .....121
New Equipment .....109
New Literature .....112
News About People .....130
News-Beat ..... 70
Readers Forum .....136
Selling .....100
Washington Wire ..... 66

INDEX TO ADVERTISERS...136

*Soggy land and heavy reels of Okonite Cable presented a rugged installation problem.* But by digging a 4-foot trench, and by "putting the Cat before the truck before the float," Guarantee Electrical Co. laid down two cables simultaneously at three miles per hour. Cables were a 15kv, 3-conductor Okolite-Okoprene submarine power cable and a 24-conductor Okolite-Okoprene submarine control cable designed to assure the continuous water supply essential to plant operation.

## *"We specified Okonite because...*

# This tough installation called for top-quality cables to assure continuous plant operation"



"Demanding assignments are 'our meat'," says Arthur Kaspar, Chief Electrical Engineer of Guarantee Electrical Company of St. Louis. "A good example is our recent cable installation for a large plant here in Missouri.

"Our client specified a never-failing, 24-hour-a-day, controlled source of plant water. The best pumping station site was miles from the plant, in low-water marsh land subject to periodic flooding from the Mississippi River—up to 25 feet above river level. One thing was certain... this called for really dependable cables for power and for control of the complex pumping station that would supply the water to the plant.

"Another thing was certain, too ... this was a job for Okonite. Our experience has taught us that Okonite gives maximum insurance and value where dependability in vital circuits is concerned."

Conferences between Mr. Kaspar and Okonite developed the proper cables: unaffected by water, highly resistant to soil conditions and other factors that attack *any* buried or submerged cable, and backed up by Okonite's 78 years of making highest-quality cable.

* * *

For your vital circuits, take a tip from Mr. Kaspar and other leading electrical engineers and specify Okonite. Whatever the installation, when you talk to Okonite you'll get an unprejudiced recommendation for your cable needs because Okonite, *and only Okonite*, makes cable by all four insulating methods: strip, dip, extrusion and taping. The Okonite Company, Passaic, New Jersey.

5248

***where there's electrical power... there's*** **OKONITE CABLE**

# Average Residential Rates

The electric companies will increase rates more in dollars in 1958 than any year in history. We are predicting a total of around $100 million compared with $58 million in 1957. We entered 1958 with applications pending for $65 million in increases.

What will this do to the average residential rate? Will it continue downward, level out or move upward? The consensus of utility people is that it will continue downward but may not drop in 1958.

We estimate that the average residential rate of class A and B companies was 2.66¢ per kwhr in 1957. This was 0.40¢ below 1948. The record of annual decrease is unbroken. However, there was no appreciable decrease in 1953, the year following the next largest rate increase year when $77 million was granted.

It would be our guess that residential will have to take on the major burden since it is here where a large share of the costs of inflation are reflected.

The increase in average use per customer has leveled off at about 200 kwhr per year for the last four years. In 1957 it dropped below this level. This will also affect average rates.

These trends will bear watching.

Fischer Black


## Electrical World Staff

**Fischer Black** Publisher and Editor
**Daniel T Braymer** Assistant to the Editor

### *Engineering*

**Leonard M Olmsted** Managing Technical Editor
**John J Kearney** Assistant Managing Technical Editor
**Howard S Knowlton** New England Editor, Boston
**Edward Allen** Midwestern Editor, Chicago
**Francis J Kovalcik** Middle Eastern Editor
**David Rea** Southeastern Editor, Atlanta
**James G Plunkett** Northeastern Editor
**Charles F Hochgesang** Western Editor, San Francisco
**Rue M Shoop** Associate Editor
**George Swift** Associate Editor
**Kenneth N McLean** Industrial Editor
**Archer E Knowlton** Consulting Editor

### *News*

**Herbert R Frankel** Managing News Editor
**Thomas R Jordan** Commercial Editor
**Theodore Fuller** News Editor **Michael G. Duerr** and **Denise McCarthy** Assistants
**John D Damon** Assistant Editor
**George B Bryant, Jr** Manager, Washington Bureau

### *Special Services*

**Arthur J Stegeman** Manager, Market Research
**Dexter M Keezer** Director, Economics Department
**E Russell Eggers** Economist

### *Production*

**Jesse A Mock** Manager of Production
**Frank C Stockman** Art Director
**H Tomlinson Howland, Jr** Associate Art Director

### *Advertising*

**Warren W Shew** Sales Manager
**District Managers:** N V Palmer, E S Chapin and D J Roberts, New York; E S Chapin, Boston; F P Coyle, Philadelphia; M S Kearney, Cleveland; M I O'Connell, Detroit; W H Meneilley and J T Schaefer, Chicago; J T Schaefer, St. Louis; Russell Antles, Los Angeles; R C Alcorn and T H Carmody, San Francisco; Robert H Powell, Atlanta; Gordon Jones, Dallas.
**Otto A Drechsel** Business Manager
**Donald K Ellis** Promotion Manager

**E Bryson Sessions** Circulation Manager



**ELECTRICAL WORLD**

Published weekly by McGraw-Hill Publishing Co., Inc., James H. McGraw (1860-1948), Founder. **Executive, Editorial, Circulation and Advertising Offices:** McGraw-Hill Building, 330 West 42nd Street, New York 36, N. Y. Printed at 99-129 North Broadway, Albany 1, N. Y. See panel at right for circulation regarding subscriptions or change of address.

Donald C. McGraw, President; Joseph A. Gerardi, Executive Vice-President; L. Keith Goodrich, Vice-President and Treasurer; John J. Cooke, Secretary; Nelson Bond, Executive Vice-President, Publications Division; Ralph B. Smith, Vice-President and Editorial Director; Joseph H. Allen, Vice-President and Director of Advertising Sales; A. R. Venezian, Vice-President and Circulation Coordinator.

Subscriptions are solicited from executive, supervisory, and engineering personnel in electric utilities, manufacturing companies, and related fields and from consulting engineers and electrical engineers in industry. **Position and company connection must be indicated on subscription orders.** Send to address shown in box at right.

United States and Canada subscription rate for individuals in the field of the publication $6.00 per year; single copies 50 cents. Other Western Hemisphere and the Philippines $20.00 payable in advance and other countries $30.00 payable in advance.

Second-class mail privileges authorized at Albany, N. Y. Printed in U.S.A. Title registered in U. S. Patent Office.



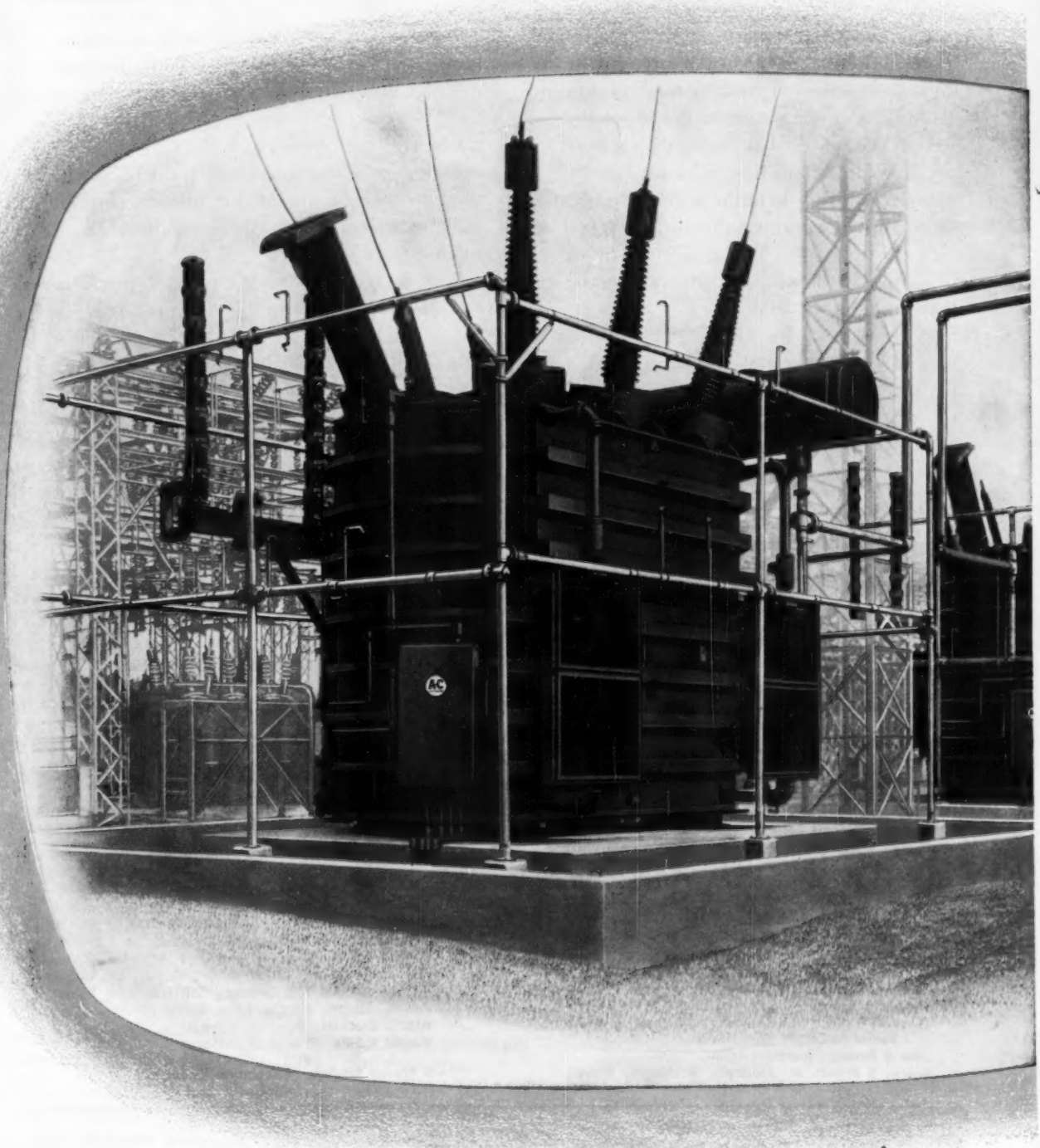
© Copyright 1958 McGraw-Hill Publishing Company, Inc. All rights reserved. Permission required to reproduce any of contents.



SUBSCRIPTIONS AND ADDRESS CHANGES: Send subscription correspondence and change of address to Subscription Manager, ELECTRICAL WORLD, 330 West 42nd Street, New York 36, N. Y. Subscribers should notify Subscription Manager promptly of any change of address, giving old as well as new address, and including postal zone number, if any. If possible, enclose an address label from a recent issue of the magazine. Please allow one month for change to become effective.

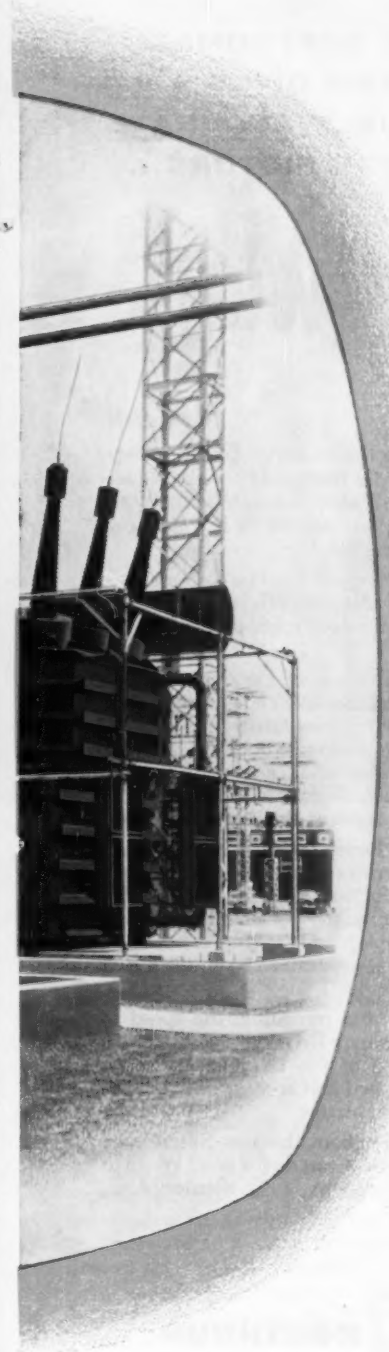
**Postmaster . . . Please send form 3579 to Electrical World, 330 W. 42nd St., New York 36, N. Y.**

# Another example of Allis-Chalmers



A-5566

leadership in transformers



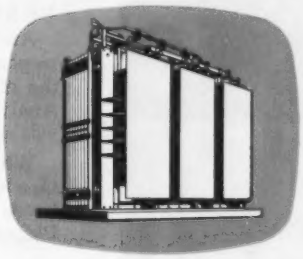
# Two 150,000-kva Autotransformers for Duke Power Co. tie 115-kv and new 230-kv lines

The use of autotransformers in the size range of the 150,000-kva units shown here allows new savings possibilities. That's why today's trend toward autotransformers is receiving increased attention.

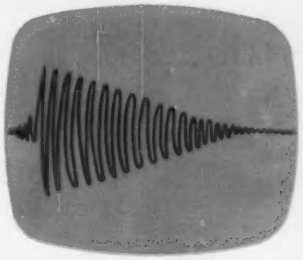
For example, it is estimated that these units cost about 40% less than conventional transformers. In addition, they are smaller, more efficient and have lower impedance.

Allis-Chalmers autotransformers are available in single or three-phase types with or without load tap changing, in all kva and voltage sizes for: interconnection of systems, phase shifting, or generating station step-up service.

For details call your nearby A-C office or write Allis-Chalmers, Power Equipment Division, Milwaukee 1, Wisconsin.

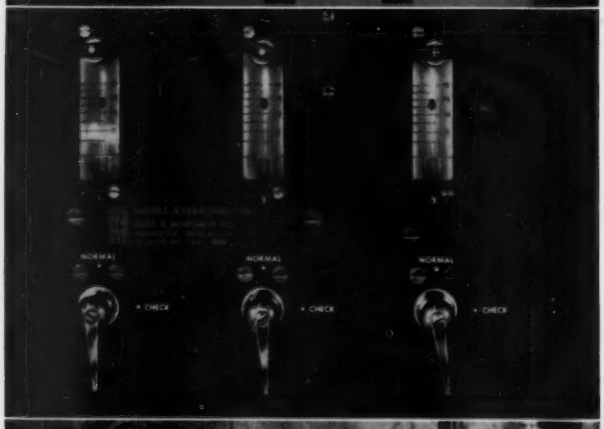


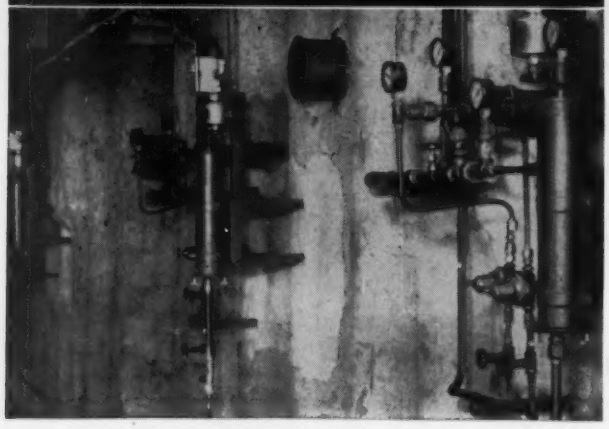
Circular coil, shell form construction used in these transformers is inherently strong, provides high impulse strength, good impulse voltage distribution.



New switching surge test plus standard impulse test subjects transformer to overvoltage surge conditions found in actual operation.

ALLIS-CHALMERS





**THE NEW SPEEDOMAX $O_2$ SYSTEM GIVES A CONTINUOUSLY ACCURATE COMBUSTION PICTURE...**

# Here's why!

■ Already, on some of the country's largest boilers, this new Speedomax $O_2$ System is enabling operators to trim excess air automatically to maintain combustion efficiency . . . and to do it with a certainty never before possible.

Why? As one operator put it, "The System gives me a record that's meaningful. When I look at this $O_2$ chart I know what's *really* happening—and I know it right away."

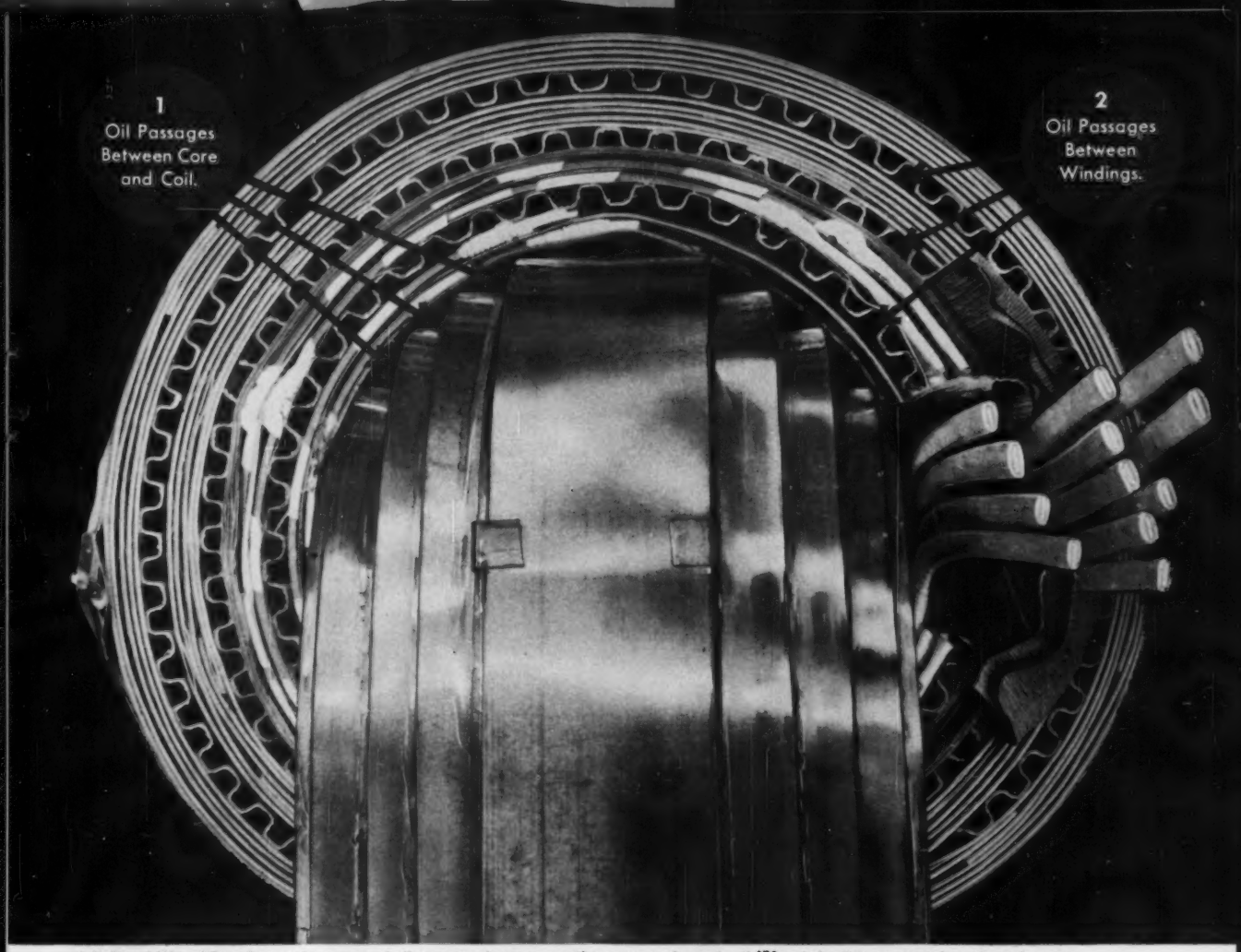
Behind this operator's confidence is the new L&N Multiple-Probe Sample Averaging Unit which *assures a more representative sample.* This unit maintains a true average from two, three, or more probes—even if individual sample flows drop 60 per cent. And excess air distribution across the duct can be checked right at the Averaging Unit.

There is also a new Reverse Jet Probe and Steam Sampler which delivers a *clean pressurized sample* even with the *dirtiest* of flue gases. Water jets flush the probe passage continually, steam ejector action pressurizes the sample, and steam condensing action plus centrifugal separation remove all dirt and acid.

And, in analyzing and recording, the speed of response of the Speedomax Recorder, coupled with the efficient operation of the L&N Magnetic $O_2$ Analyzer, increases speed and accuracy of $O_2$ analysis and recording even further.

Why not learn more about this new Speedomax $O_2$ equipment and what it can do for you? Write to Leeds & Northrup Company, 4938 Stenton Ave., Philadelphia 44, Pa.

LEEDS NORTHRUP
*instruments* *automatic controls* • *furnace*




L-M Round-Wound Transformers have natural oil passages between cruciform core and round coil **(1)** to help dissipate heat from the coils more rapidly. In addition, ducts provided by spacers placed between windings **(2)** and between layers in most sizes provide additional oil circulation.

# Why More Customers Are Selecting L-M Round-Wound® Transformers

Many factors enter into transformer selection. Here are some of the reasons for the great increase in customer preference for L-M's obround-shape Round-Wound transformers.

**Balanced Performance:** The core is a continuous wound strip of oriented steel. Coils are wound directly onto this core. Since the core is not cut, unwound, or disturbed in any way after annealing, there are no air gaps to break up the flux. This results in low exciting current and core loss.

The wound-core, round-coil design permits fewer winding turns and smaller turn diameter. This results in low impedance, and provides better regulation at all power factors.

**Higher Uniform-Impulse Level:** Round coils are wound into shape. Therefore, insulation is not damaged by malleting into rectangular shape. Coils have longer creepage distance between windings and between leads.

**Higher Short-Circuit Strength:** Round coils are not stressed out of shape under high radial short-circuit forces. Strong steel frame, heavy clamping bolts, sturdy maple blocks and varnished coils prevent axial movement.

**Higher Short-Time Overload Capacity:** Round coils and the cruciform cross-section core expose large surfaces to cooling oil. The result is relatively low hot-spot temperatures, which add considerably to high short-time overload capacity.

**Additional Capacity on Pole:** L-M's new obround tank design makes the unit smaller and lighter, with shorter moment arm from the pole. This combination reduces bending moment on the pole and crossarms, and thus greatly increases potential capacity of existing transformer structures.

**Get Complete Information**

Ask your L-M Field Engineer for complete information and bulletins on L-M's Round-Wound Transformers. Or write Line Material Industries, Transformer Division, Zanesville, Ohio.

HH-R

LM® **LINE MATERIAL**
McGRAW-EDISON COMPANY

L-M's obround transformer is small, light, and has short moment arm distance from the pole. Total bending moment is greatly decreased and potential capacity of all your transformer structures is increased. Good regulation, high overload capacity and other Round-Wound characteristics have been fully maintained in L-M's obround design.

# L-M's Obround Design Provides Less Bending Moment On The Pole

By **D. A. MANNING**
Assistant Product Manager
Transformers
Line Material Industries

L-M's exclusive obround transformer provides a smaller tank with less transformer oil, resulting in a light, easy-to-handle transformer. The obround design also brings the center of gravity of the transformer closer to the pole. The combination of light weight and short moment arm substantially reduces the total bending moment on the pole, and thus greatly increases the potential capacity of all your transformer structures. This advantage was accomplished without changing the outstanding performance characteristics of the Round-Wound® design.

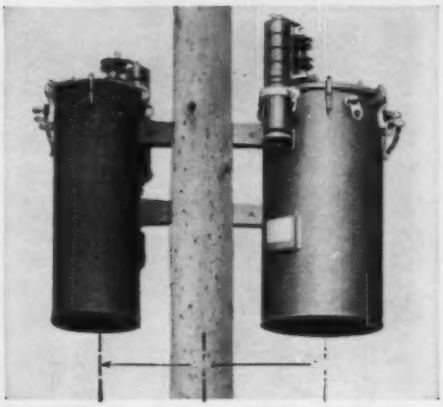
A comparison with four other major makes shows that the low bending moment of L-M's obround design is exceeded by as much as 50%. See the chart.

**COMPARE Percent Bending Moment for All Five! See why more customers are selecting L-M obround transformers.**

| RATING | MANUFACTURER | | | | |
|---|---|---|---|---|---|
| 2400/4160 Y Voltage | Percent of L-M Bending Moment | | | | |
| | LM | A | B | C | D |
| 25 KVA | 100% | 110% | 123% | 133% | 128% |
| 50 KVA | 100 | 123 | 113 | 142 | 120 |
| 100 KVA | 100 | 123 | 115 | 137 | 132 |
| 167 KVA | 100 | 105 | 093 | 115 | 091 |
| 7200/12470 Y Voltage | LM | A | B | C | D |
| 25 KVA | 100 | 131 | 124 | 149 | 126 |
| 50 KVA | 100 | 123 | 110 | 150 | 119 |
| 100 KVA | 100 | 119 | 122 | 149 | 125 |
| 167 KVA | 100 | 107 | 087 | 112 | 089 |

In addition to reducing the bending moment for equivalent transformer ratings, you can now hang transformers of larger capacity on a pole structure and take advantage of savings such as these:

- Single-pole, three-phase transformer structures can now hold three 50 kva obround transformers instead of three 37½ kva round tank transformers. Thus you obtain 33⅓% more capacity and 15% less bending moment on the pole, and eliminate the need for a costly two-pole structure.
- Three 167 kva obround transformers can now be installed on a two-pole structure, obtaining 67% more capacity and less bending moment on the pole than with three 100 kva older-design transformers.



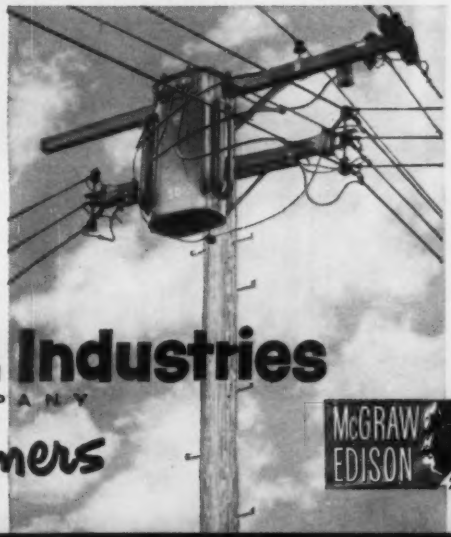
Comparison of these two 25 kva transformers shows how much closer the center of gravity of the obround design is to the pole than with the round design. The result is less bending moment on the pole.

**Round-Wound Performance**

An outstanding fact to consider on the L-M obround transformer is that, unlike the extremely light transformers of some manufacturers, there has been no sacrifice of performance characteristics. The obround retains all the outstanding performance characteristics of L-M's Round-Wound core-coil design. These characteristics include low exciting current, low noise level, high impulse strength, high short-circuit strength, high short-time overload capacity and many others.

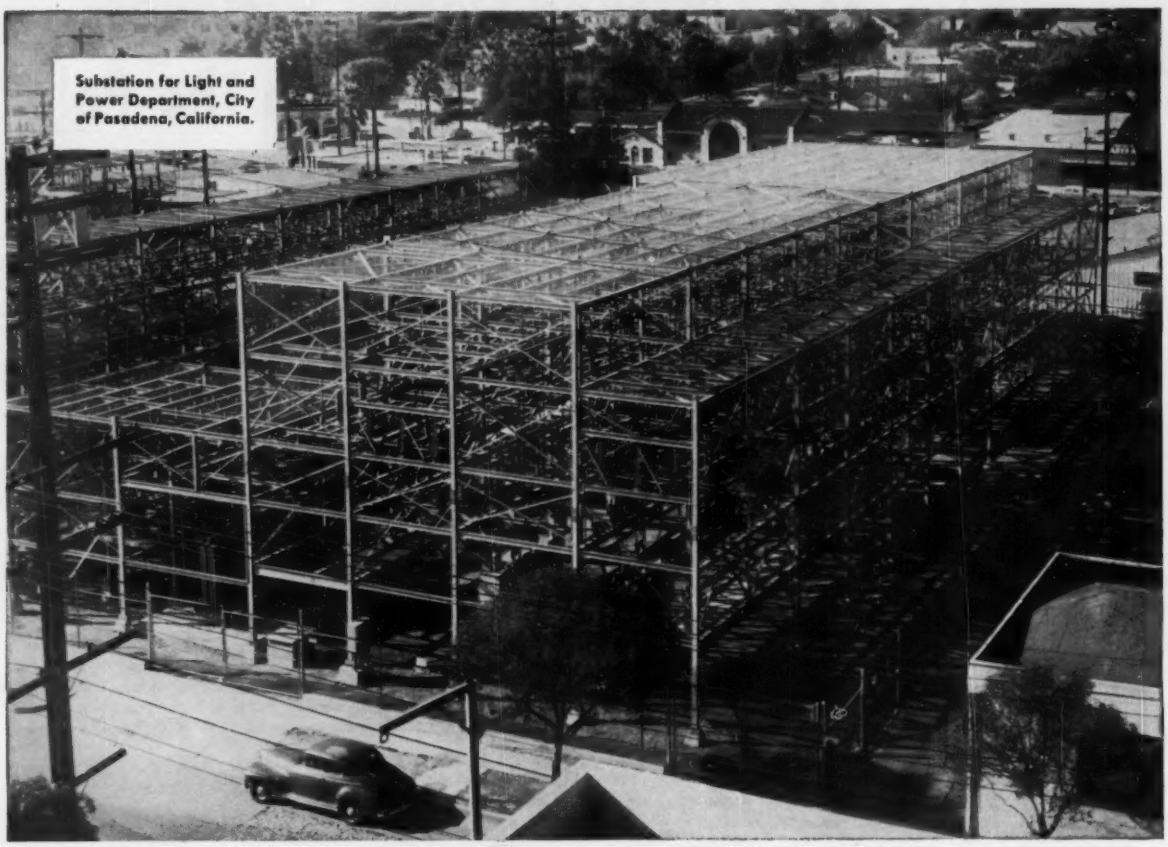
**Get Details on L-M's Obround Transformer**

Ask the L-M Field Engineer for application information, weights and dimensions on obround transformers and L-M's exclusive Round-Wound design. Or write Line Material Industries, Transformer Division, Zanesville, Ohio.



LM® **LINE MATERIAL Industries**
McGRAW-EDISON COMPANY
Transformers

McGRAW EDISON



Substation for Light and Power Department, City of Pasadena, California.

13.2 KV/240 volt transformer substation for Mayville Metal Products Company, Mayville, Wis.

# LARGE or SMALL

## *All 3E Substations get personalized design.*

**Custom design . . . Not customary equipment** is the key to high efficiency at low cost. Substations designed specifically for the job are in close accordance with ideal engineering practice. They deliver maximum service at minimum cost and are free from hazardous short cuts or the unnecessary costs due to standardized procedures. 3E's knowledge of structural design and pre-fitted parts allows rapid erection at low labor costs and lengthens service life.

**The advantages of personalized service . . .** With 47 years experience concentrated on substation and switchgear, 3E's engineering staff is ideally suited to help you get the best design and equipment for your needs.

Whether you invite bids from a rough sketch or complete specs, 3E can offer a complete service, a fine design staff, a full line of indoor and outdoor switchgear and a modern plant capable of a wide range of custom fabrication.

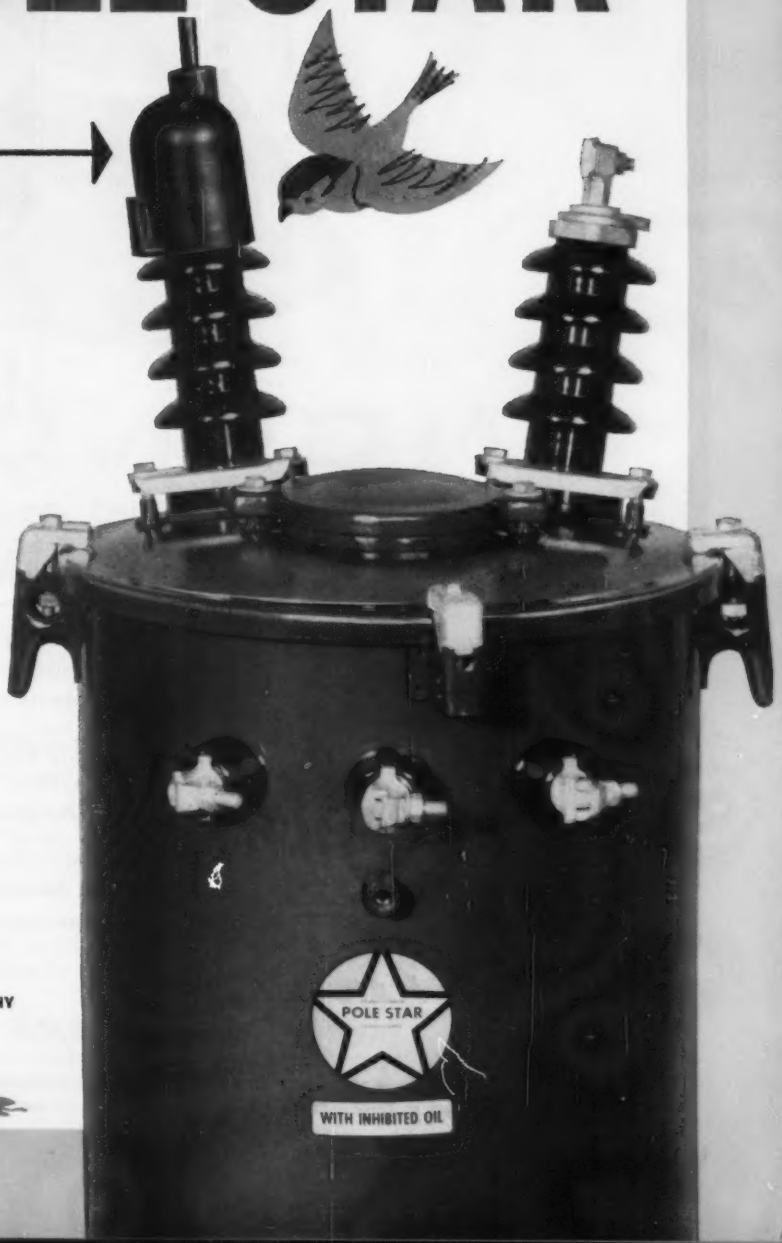
3E

**ELECTRICAL ENGINEERS EQUIPMENT CO., MELROSE PARK, ILL.**
Representatives in principal cities

# Wildlife a problem in your area?

# POLE STAR®

offers an optional neoprene cap that slips easily over high voltage cover bushings. It protects your Pole Star transformer... and wildlife... without affecting the long-proved reliability of Pole Star's standard bushing




McGRAW-EDISON

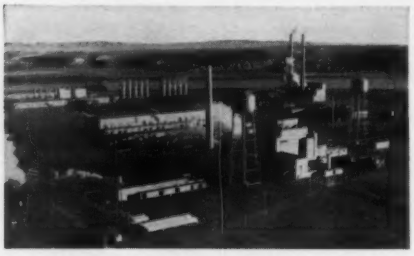
**Pennsylvania Transformer Division** McGRAW-EDISON COMPANY

CANONSBURG, PA. Greater Pittsburgh District

call KE for plant expansion or new facilities

# INGENUITY

## has made KE the experienced leader in nuclear projects



Project: construction of large plutonium production plants. KE work involved reactors, shielding, extensive instrumentation, stainless steel piping, machinery installations and other complex construction. KE completed job ahead of schedule and below the budget.

Cost-saving and time-saving ingenuity, plus a wealth of nuclear experience—these are two of many reasons why Kaiser Engineers has been selected for so many of America's challenging nuclear projects. To date, value of KE nuclear projects amounts to more than $165,000,000.

KE provides complete nuclear engineering and construction services—including concept feasibility, reactor criteria, facility design, construction and test operations.

KE nuclear specialists are ready to serve you today. Call KE for design and construction, or any aspect, of nuclear research, production or power facilities.

KAISER ENGINEERS engineers—contractors
Contracting since 1914

Division of Henry J. Kaiser Company • Oakland 12, California • New York, Pittsburgh, Washington, D.C., Buenos Aires, Calcutta, Dusseldorf, Montreal, Rio de Janeiro, Sydney, Tokyo

4383

*News about*

# B.F.Goodrich Chemical *raw materials*

## Control cable lasts longer with insulation of Geon

CABLE insulated and jacketed with Geon polyvinyl materials is lightweight, easy to install and splice. No braids to rot or wick moisture; no lead to corrode or be eaten away by electrolysis.

Insulation compounds of Geon are strong, weatherproof, keep their exceptional properties with age. They resist flame, will not support combustion, and have good flexing properties. They also resist oil, grease and chemicals.

For information about Geon wire and cable covering, write Dept. LR-3, B.F.Goodrich Chemical Company, 3135 Euclid Ave., Cleveland 15, Ohio. Cable address: Goodchemco. In Canada: Kitchener, Ont.

**B.F.Goodrich Chemical Company**
**a division of The B.F.Goodrich Company**

B.F.Goodrich

GEON polyvinyl materials • HYCAR American rubber and latex
GOOD-RITE chemicals and plasticizers • HARMON colors

**HE CAN "MEASURE" MORE PROFIT FOR YOU.** This Dowell service engineer can measure the amount of scale he removes from a line, using the Dowell method of chemical cleaning. *This removed scale and sludge can also be measured in increased profit dollars for your company.*

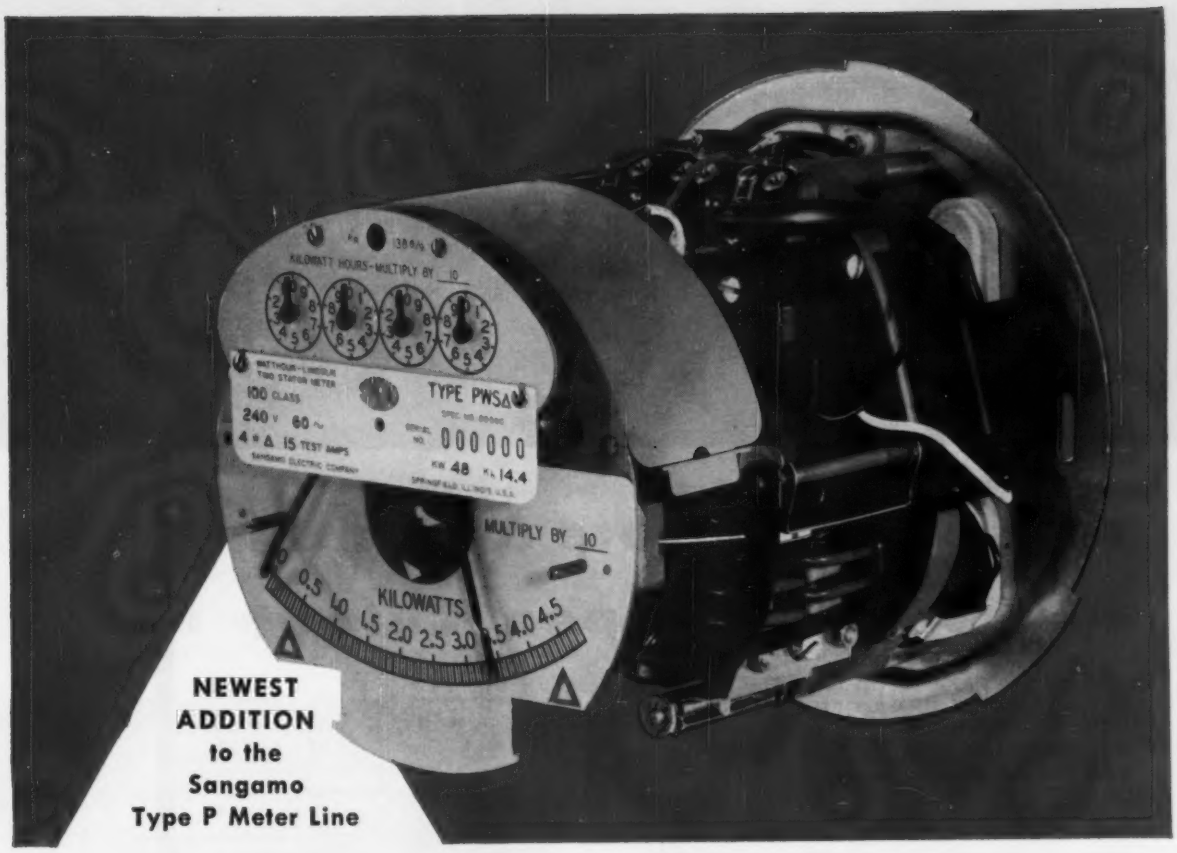
Example: Scale build-up in the main water supply line of a major Midwestern plant had reduced the "C" factor from 105 to 72. This situation became apparent just at the start of the peak season for the company. Management had a choice between laying an auxiliary line or trying to clean their present one. They decided to clean the line—but not the old-fashioned mechanical way. Time would not permit. Dowell was called in to do the job—chemically.

Dowell Service was fast—the job was done in three days. Dowell Service was effective—the "C" factor was increased to 92. Dowell Service was profitable for the customer—$71,000 was saved and the company's annual profit was protected.

With Dowell Service you receive the benefits of more than fifteen years experience in chemical cleaning—plus a full line of equipment, chemicals, and trained personnel. You pay one charge, get an efficient job, handled by experienced people.

Your maintenance and operating engineers probably know about Dowell Service. Ask them for the facts. Decide for yourself about the additional profit possibilities to your company with Dowell Service working for you. DOWELL INCORPORATED—A SERVICE SUBSIDIARY OF THE DOW CHEMICAL COMPANY. Headquarters and research center, Tulsa, Oklahoma, with 165 offices and stations to serve you.

*Chemical cleaning service for industry* DOWELL




**NEWEST ADDITION to the Sangamo Type P Meter Line**

# Sangamo Type PWSΔ—compact polyphase Combination Watthour and Lincoln Demand Meter

**NOW** . . . for convenient, dependable demand measurement of all polyphase circuits . . . Sangamo presents the Type PWSΔ combination watthour/thermal-demand meter.

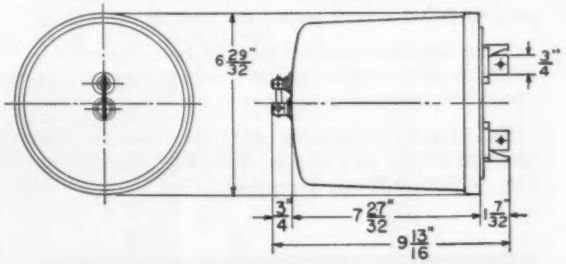
**ALL NEW DESIGN** combines the features of Sangamo's new two-stator four-wire delta meter with the time-proven Lincoln watt demand meter. Both the watthour meter and the demand meter are complete units that function independently on entirely separate circuits.

**COMPACT CIRCULAR CONSTRUCTION . . . USES CONVENTIONAL ROUND COVER**

The Type PWSΔ is a compact assembly that is mounted on a standard circular base plate, and is enclosed by a conventional round glass cover. The PWSΔ is built like—and looks like—the popular Sangamo Type J2TS.

**EASY TO READ—EASY TO ADJUST.** Kilowatthour dials are never obstructed by the demand pointers. Simple and readily accessible adjustments are provided for both demand and watthour meters.

**EASY TO MAINTAIN.** All Lincoln secondary leads are solder-connected at convenient junction blocks. Register assembly can be removed without disturbing soldered connections for easy access to watthour meter components. Watthour meter—including bearing system—is *guaranteed for life.*

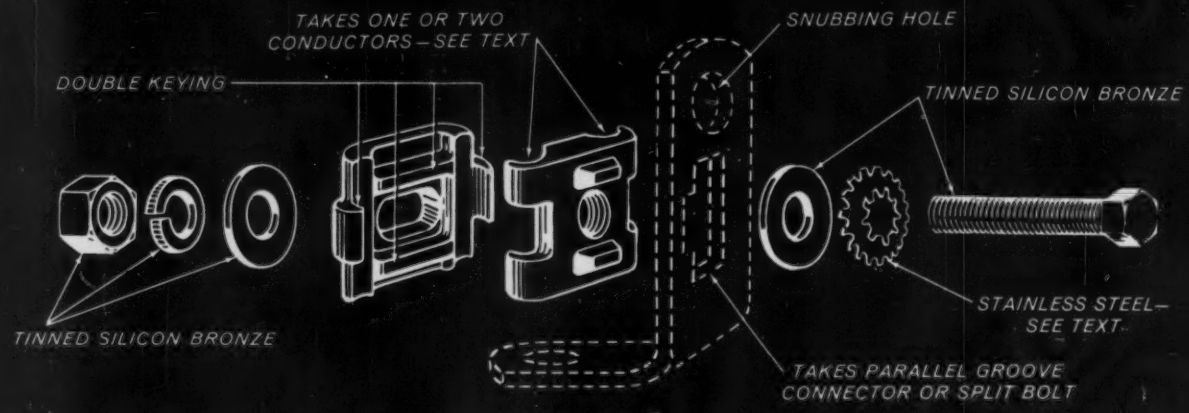



*THE COMPLETE LINE OF SANGAMO TYPE P METERS WILL HANDLE ALL POLYPHASE MEASUREMENT*

**SANGAMO ELECTRIC COMPANY**

SM.58-1

SPRINGFIELD, ILLINOIS




# now! parallel groove connectors on S&C's Open Cutout

If you're coming into a cutout with aluminum, chances are you will want a parallel groove connector. With S&C's Type XS Open Cutout you can have this feature at no charge.

Expressly designed for use with aluminum conductors, this new parallel groove connector has an unusually large gripping area. The connector halves are doubly keyed to each other, insuring uniform gripping of conductor, regardless of size. The connector takes one or two aluminum conductors—copper too, of course—up to 2/0 stranded or 1/0 ACSR.

Making connections is easy. Connector halves are keyed to each other and to the cutout to prevent rotation. You need only one wrench to make up the connectors, since a stainless steel internal-external tooth lockwasher holds the connector body mounting bolt against turning. And, for each tightening of the connector with lineman's tools, there is a generous size nut—5/8" across flats.

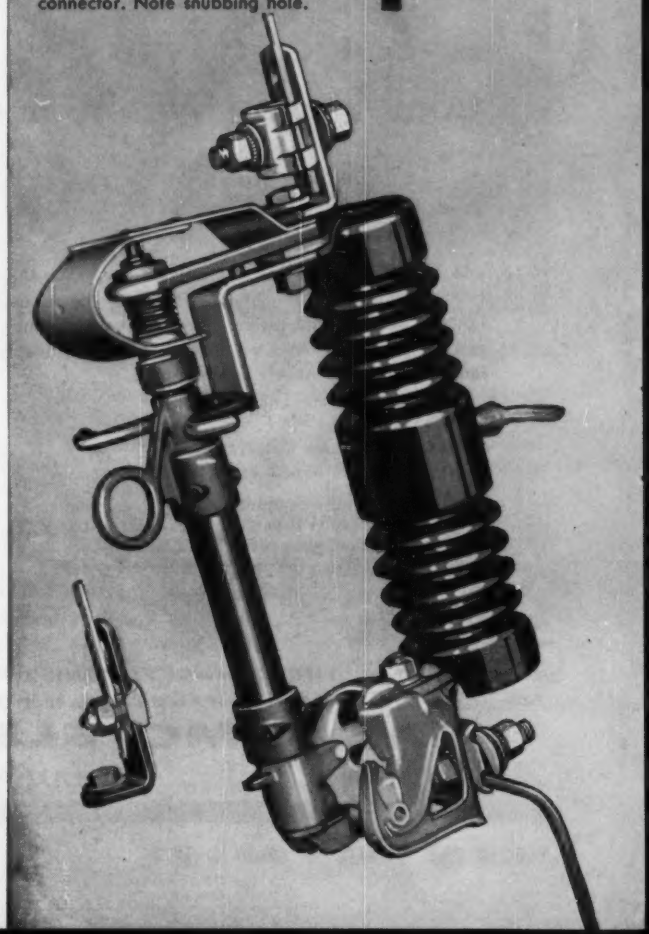
Larger parallel groove connectors are available at slight charge. These connectors accommodate one or two conductors, from No. 2 solid aluminum (or copper) to 4/0 standard aluminum, copper, or ACSR.

As an optional standard the split-bolt connector is available at no extra charge. Maximum conductor size is No. 1 stranded—copper or aluminum.

S&C Electric Company, 4421 Ravenswood Ave., Chicago 40, Ill. In Canada: S&C Electric Canada, Ltd., 8 Vansco Road, Toronto 14, Ont.

S&C ELECTRIC COMPANY

Type XS Open Cutout—7.5 kv, 100 amperes continuous, 12,000 amperes interrupting—shown with parallel groove connectors. Insert (below) shows optional split-bolt connector. Note snubbing hole.



# The Electrical Newsletter

**FUTURE NEWS ▶** **Look for two more utilities to break away** from one of the large nuclear power groups and study the possibility of building additional A-plants. These utilities will propose such plants either individually or as the nucleus of new groups.

**Another large northern utility is considering resistance heating.** Reason: Summer peaks inching up toward its area, and a competitive rate structure.

**Test run on plan for tracking storms by EEI companies** in eastern U.S. will be made soon. Three more companies have joined the group.

**LATE NEWS ▶** **Retention of natural beauty has won for West Penn Power** a 1958 "Plant America" award for its general office site, Cabin Hill. WPP is the only utility winner among 29 industrial firms in the fifth annual contest sponsored by American Association of Nurserymen.

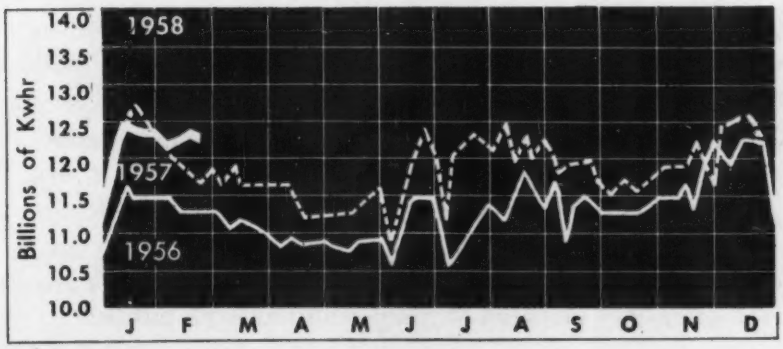
**Pacific G&E is now buying land for a second nuclear power plant** at an unspecified coastal location. It would be larger than the first one, a 50-Mw facility recently announced (EW, Feb. 24, p 65).

**GE abandons "fair trade" on all small home appliances.** Move, made by a principle proponent of the system, is seen to hasten shifts to free pricing by the few remaining "fair traders" in the field.

**New Hampshire legislature passes utility franchise tax** in place of levy invalidated by State Supreme Court. New tax, limited to 16 months, is 4% of net operating revenue and affects 18 electric and gas utilities. It will produce about $650,000 a year.

**Management changes . . . Duquesne Light ups W. A. Conwell** to VP of engineering and construction . . . New Tampa Electric VP's are M. T. Anthony, who'll handle sales, and C. H. Schwaner, finance.

**Power Output—Up 3.5% (Week ending Feb. 22), Kwhr 12,338,000,000**




Per Cent Change From Previous Year

| | Feb. 8 | Feb. 15 | Feb. 22 |
|---|---|---|---|
| Total U.S. | +2.2 | +3.9 | +3.5 |
| New Eng. | +1.9 | +2.4 | +5.5 |
| Mid. Atlan. | +0.9 | +3.1 | +2.5 |
| Cent. Ind. | −1.8 | +0.6 | +0.3 |
| West Cent. | +1.8 | +7.3 | +6.0 |
| Southeast | +10.0 | +8.4 | +8.2 |
| South Cent. | −0.1 | +3.6 | +4.2 |
| Rocky Mount. | +2.1 | +0.8 | −1.1 |
| Pacific | | | |
| NW | +1.5 | +4.8 | +1.3 |
| SW | +0.6 | +3.7 | +3.0 |

Seasonally Adjusted Index 234.8

Week ago 234.9 Year Ago 226.4

Atomic Energy Commission requirements—1,050,000,000 Kwhr (Electrical World estimate). Excluding AEC, output increase was 4.8%.

# A TWO-MINUTE PREVIEW OF THIS ISSUE

**THE ECONOMY** ▶ **You can look for a leveling out of the U.S. economy** during the next few months, with an upturn during the second half of the year. This prediction, from McGraw-Hill's Economics Dept, is based on proposed expenditures by federal, state, and local governments. But the economic outlook for various regions remains mixed (p 68).

**ATOMIC PROGRESS** ▶ **We can outshine the Russians in developing atomic energy** for peaceful applications and at the same time develop competitive nuclear power in this country, contends Atomic International's Dr Chauncey Starr. His two-purpose plan, which would subsidize construction and operation of U.S.-built reactors abroad, highlights current hearings into the progress of the atomic industry (p 67).

**EVENTS** ▶ **How can utility purchasing agents cut costs through wise buying?** Speakers came up with a wealth of cost-cutting tips at the recent Public Utility Buyers' Group meeting (p 64).

**WASHINGTON** ▶ **Administration drafts compromise plan** to solve REA financing problems. Four-point plan aims at de-emphasizing 2% loan rate (p 66).

**AIEE** ▶ **Attendance hit a record of 5,340** at AIEE's winter general meeting last month. The highlights of 400 papers presented at 100 technical sessions and symposiums are brought into sharp focus in a special 12-page report (p 71-82). Electrical World's coverage is concentrated in seven specific areas as follows:

- **Distribution**—Safety aspects of a higher utilization voltage were debated by experts. Standardized feeder protection, sub-transmission planning, and 46-kv oil reclosers were also discussed.
- **Cable**—Two methods have proved economical in deriving full capability from a cable buried in soil of poor thermal quality.
- **Transmission**—Abnormally high flashover rates are still puzzling transmission men. But, silicone grease, sources of radio influence, and high-voltage-cable research also occupied their interests.
- **Substations**—A new transistorized bushing potential device has proved economical for use with a 46-kv breaker to obtain instrument and protective relay voltages.
- **Relays**—High-speed reclosing has been used successfully on 345-kv lines; a new compensator distance relaying scheme, using a minimum of moving parts, has been developed.
- **Generation**—A new method was proposed for determining reserve generating capability. Economic dispatch, digital computers, and protection of a supercritical-pressure unit were also discussed.
- **Industrial**—New formulas simplify computation of voltage drop in commercial buildings. Other papers dealt with ac network analyzers in plants and problems of tying industrials with utilities.

**EARNINGS** ▶ **Net incomes rose 5.9% in 1957** for a group of 90 operating electric utilities, to reach an all-time high of $968,881,929. A study of year-end financial statements also shows top earnings shifting southeastward, with Mississippi Power and Florida P&L chalking up biggest percentage gains over '56. What about '58? EW predicts a further 7% gain as electric business grows and power rates rise **(p 113).**

**DISTRIBUTION** ▶ **Alabama Power develops new methods for bundling bus and service** at a two-pole platform structure which supports high-capacity transformers. Method, which saves time and materials, eliminates the conventional secondary bus and permits running the multi-conductor secondary from the transformer to the customer **(p 89).**

**INDUSTRIAL** ▶ **One manufacturer solves the problem of high power factor rejects** by using two electrically heated ovens to dry condensed surface moisture on core-coil assemblies. The units, at Kuhlman Electric, also lower first cost and require little maintenance **(p 104).**

**SELLING** ▶ **Flexibility is the keyword of the modern auditorium** and electric center Duke Power just added to its general office building. The center, completely equipped to handle many different types of functions has been called the best such utility facility **(p 100).**

**MANUFACTURERS** ▶ **A new million-dollar lab designed to reduce transformer noise is** opened by Pennsylvania Transformer Division of McGraw Edison Co. The lab houses complete testing and analyzing facilities **(p 69).**

**Features of a new induction motor for boiler feed pump service** are top air "straight-up" ventilation and acoustically correct "silent" operation. They have just been introduced by Electric Machinery Mfg . . . GE sets new record in sales and earnings for 1957. Employee earnings and payments to the suppliers also hit new peaks **(p 124).**

**NEW EQUIPMENT** ▶ **Just introduced is a power-switching accessory for breakers,** designed to reduce arcing hazards and prevent phase-to-phase faults. It's available for horizontal and vertical break switches. . . . An improved outdoor motor, in ratings of 250 hp and up, requires up to 33% less floor space than former models, features easier maintenance. . . . Low voltage air circuit breakers with hydraulic closing mechanism are introduced in 225 and 600-amp ratings **(p 109).**

**PEOPLE** ▶ **Jim Stuart, Dayton P&L's new president, tells how he avoids ulcers** and discloses his management philosophy in EW's profile on **p 130.** In the election, F. M. Tait and K. C. Long get new titles. . . . Anderson Electric ups J. H. Schuler to VP-operations **(p 132).** . . . P. D. Reed announces he won't seek re-election as GE chairman **(p 133).**

**Blasting a narrow trench in the river bed with water jets** from a plow-like rig, which guides cable into the crater before it backfills, speeds installation of submarine cables. Excavation up to 16 ft is feasible in most river beds although hard clay or stones may limit depth to about 6 ft. The method also has been used to lay pipe and flexible plastic tubing.—**Postrat Schroder, Distribution of Electricity, Jan 1958.**

**Because of "economic depreciation" (purchasing power of the dollar)** the electric utility industry is spending $100 million a year in undue federal taxes, declaring "phantom profits," and paying dividends out of real operating costs and possibly even out of capital. It is also underpricing its product through lack of recognition of the true costs of operation. There should be more understanding, unity, and action to meet economic depreciation. The subject should be studied for unified industry action, and top management should be educated on the subject.—**F. Warren Brooks, Electric Light & Power, Feb 1, 1958.**

## TECHNICAL NOTES

**Gas-turbine station cooling water requirements vary** from 0.04 gpm per kw to 0.2 gpm per kw depending on cycle and unit size. These values are much smaller than the 0.8 to 1.0 gpm per kw common for steam electric stations.

**Increase in system load that can be supplied by the first unit** added to the system becomes small in percent of its own capability as the size of the added unit increases. However the effect of size on the usable capability becomes smaller as more units of the new size are added to the system.

**Improved throttle pressure regulation and more stable output** following a load change at low-load conditions can be obtained by sending load-change impulses into the boiler control system.

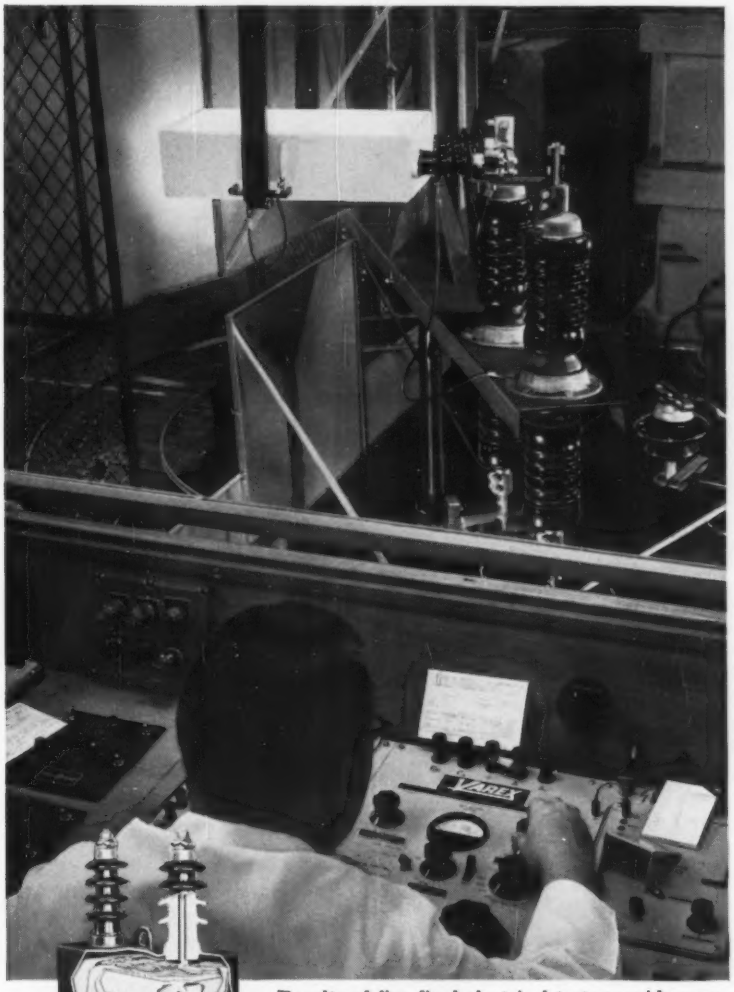
**A sum of $50,000 per 1,000 Mw of system peak load** is often quoted as the annual saving to be realized by using an automatic computer for system load dispatching.

## FROM EDITORS IN THE FIELD

**Operating experience with Ohio Edison Co's economic dispatch computer** showed that damping the indications fed to the computer for plants electrically close to the tie lines with rapidly swinging loads, was not necessary to minimize fluctuations for the desired generation solution.

# VAREX Tests Simulate 20 Years of Service in Five Minutes

**THEY GIVE THE ANSWERS ON PERFORMANCE CHARACTERISTICS BEFORE O-B CAPACITORS ARE INSTALLED**



Results of five final electrical tests provide accurate measurement of how Varex unit will perform.

Interested in knowing what will happen to this capacitor under a lightning impulse, or switching surge? Want to know whether you're getting the kilovars you pay for? If it should be necessary to discharge the unit, will it discharge during the prescribed period?

We're just as anxious as you are to know the answers. And we don't want to wait 20 years to get them. They're available on every Varex unit as soon as it's finished.

Every Varex capacitor goes to this final electrical test area -- the conveyor system is set up so it can't go anywhere else -- and it receives five tests: 1) line-to-line overvoltage (dc); 2) check on discharge resistors; 3) terminals-to-case overvoltage; 4) capacitance measurement under rated name plate ac voltage; 5) loss measurement.

In all these tests we go well beyond NEMA requirements so that we can be sure the capacitor that passes them will have minimum losses, maximum protection against switching surges and lightning impulses, ability to withstand heat storms and low temperatures, and the ability to deliver the right KVAR output at rated voltage.

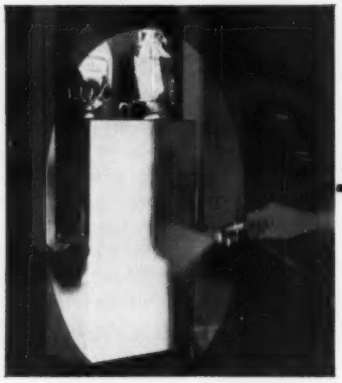
In five minutes these tests will tell facts about performance that might take 20 years of service to find out.

OHIO BRASS COMPANY, MANSFIELD, OHIO

Ohio Brass

# Every VAREX Capacitor Gets this Two-Way Protection

## ① DURABLE EPOXY ON THE CASE



Epoxy-resin paint used on Varex is most durable finish commercially available for this class of material.

## ② PACKAGING PROTECTION RIGHT UP TO THE POLE TOP

Extra-heavy carton has gross rating of 160 pounds, more than 40 pounds above heaviest 50-KVAR unit.

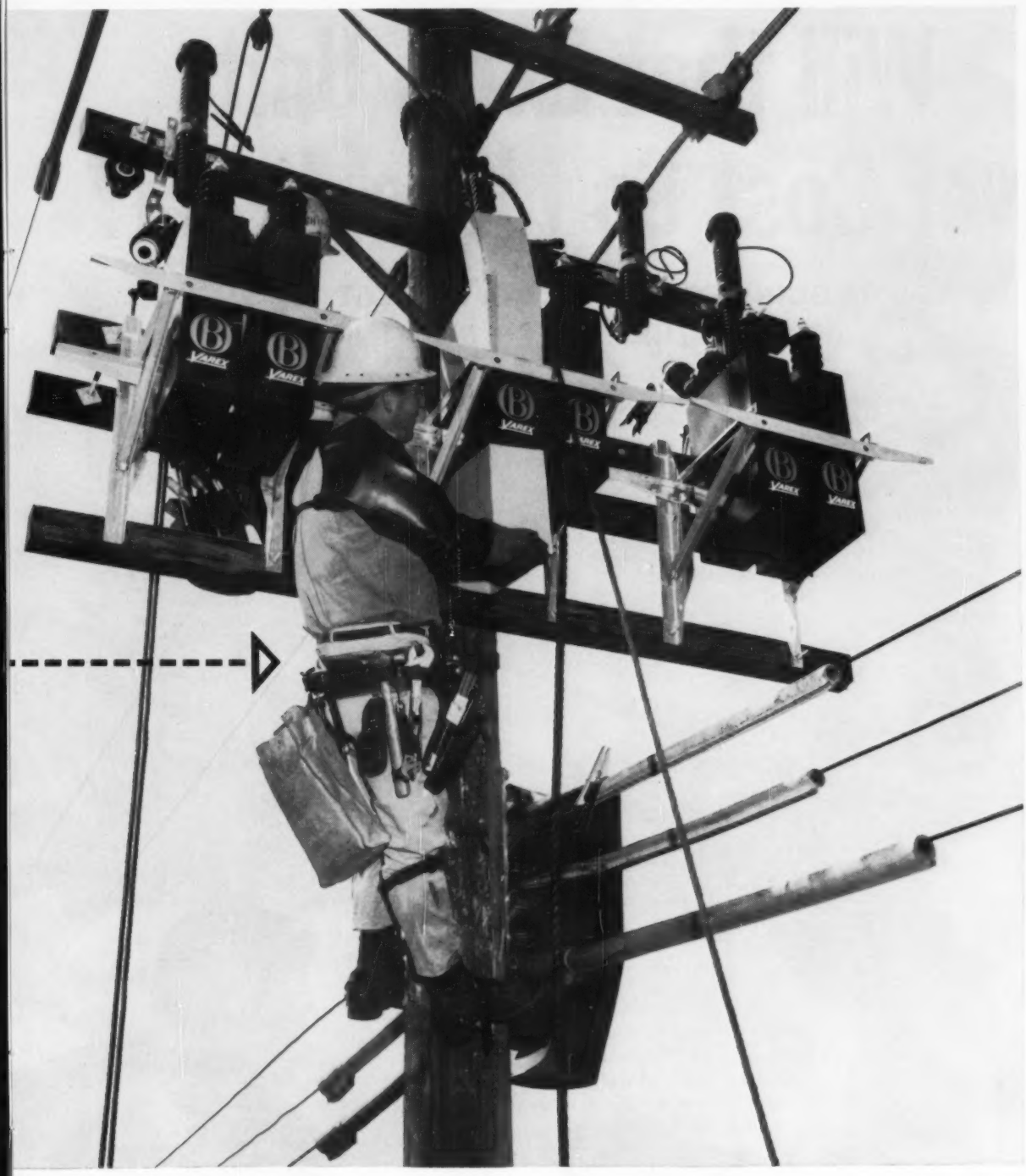
At the end of the assembly line, each Varex unit is packaged in a carton having a gross weight rating of 160 pounds. Inside the carton are a special split liner that fits around the capacitor case, two liners that fit over the bushings, and heavy spacers that reinforce the carton and give extra protection at the narrow sides of the unit.

All this protection can be left intact until arrival at the installation site. Then the outer carton is removed but the inner liner is left in place, and can be left in place until the unit is bolted in place.

But the real protection is just beginning. For underneath the carton liner is special epoxy-resin finish used on all Varex cases. This is the new finish — available only on Varex—that has been proved superior to other resin base paints on corrosion resistance, abrasion resistance, flexibility and adhesion.

You get this two-way protection with every Varex capacitor — 1) complete protection against weather after the unit is installed; 2) protection against damage in handling right up to the pole top.

OHIO BRASS COMPANY, MANSFIELD, OHIO




Ohio Brass

# Will that Extra Unit Ever Cost So Little Again?

## IF YOU'RE GOING TO NEED EXTRA INSULATION—EVER— NOW IS THE TIME TO PUT IT IN

Remember after World War II when $10,000 seemed like a big price for a five-room house? That's the house that will cost $20,000 today.

During the same period, the price of a primary deadend insulator has increased, too. But the cost of the insulator is only a fraction of the cost of putting it in the air. Changing a deadend from one to two insulators, or from two to three, costs much more than the insulator. And certainly, it will cost even more ten years from now.

Nearly everyone is restudying future distribution voltage requirements, and deciding now which distribution deadend will provide adequate insulation for tomorrow's voltages. They know system voltages are going higher, much higher.

The point is plain. If you're ever going to need extra insulation in your distribution deadends, now is the time to install it . . . as you rebuild existing lines and build new ones.

That extra insulator will never cost so little again!

OHIO BRASS COMPANY, MANSFIELD, OHIO

4882-H

# Where does progress begin?

Kendall Preston Jr., S.M. in engineering from Harvard University . . .
graduate of the Laboratories' Communications Development Training Program.

Progress begins in the mind—in the perception and appreciation of new ideas. In the past the ideas that sparked progress too often had to wait on the random interest of genius. Today more and more new ideas come from men trained to an awareness of that which is yet to be accomplished.

At Bell Laboratories, communications science is entering upon its most challenging era in history. As never before, progress will depend upon men who have acquired the special training needed to think creatively in this exciting field.

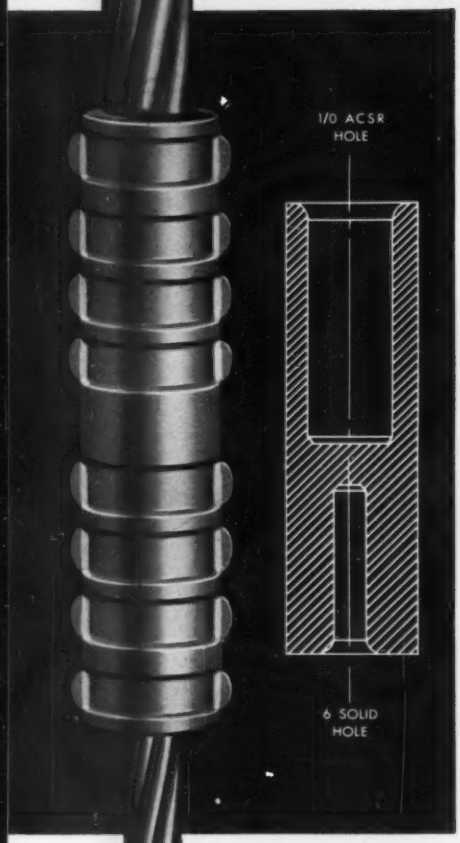
Bell Laboratories provides the young college graduate with unique opportunities to develop his creative abilities. During his first two years, he spends two or three days a week as part of his job, taking postgraduate courses in basic mathematics, physics and electronics. This he does at a graduate study center which has been established at the Laboratories by New York University. As he gathers a broad fundamental knowledge which will enable him to tackle every type of communications problem, he also gathers credits toward advanced degrees. To round out his education, he spends a third year on special phases of communications technology.

By helping scientists and engineers to reach their top development, Bell Laboratories has helped to make your telephone system the world's best—and will keep it so.

**BELL TELEPHONE LABORATORIES**

WORLD CENTER OF COMMUNICATIONS RESEARCH AND DEVELOPMENT

# You get HIGHER CONDUCTIVITY with BLACKBURN SERVICE ENTRANCE SLEEVES




## because Blackburn... and Blackburn alone... provides GREATER CONTACT AREA where needed

**Hole Depth Increases With Size of Conductor... thereby providing more contact area for the conductors being connected.**

| COLOR CODE | WIRE SIZE ACSR | WIRE SIZE AWG | HOLE DEPTH IN INCHES |
|---|---|---|---|
| Brown | – | 8 sol — 10 str | .820 |
| Green | – | 6 sol — 8 str | .840 |
| Blue | 6 | 4 sol — 6 str | .860 |
| Orange | 4 | 2 sol — 4 str | .925 |
| Red | 2 | 1 sol — 2 str | 1.010 |
| Yellow | 1/o | 1/o str | 1.185 |

The center stop in a Blackburn Sleeve is a solid barrier that assures proper distribution of the inhibitor around the conductors.

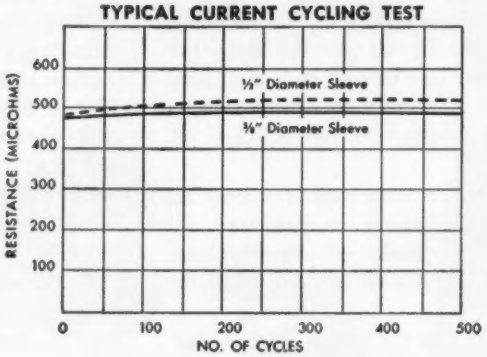
**FIRST!** Printed (not indented) permanent COLOR CODING is *easier to read*—makes size identification positive and quick.

**FIRST!** Aluminum Sensitized Tape seals the Blackburn Sleeve's ends. Easy to puncture... and, if a particle of the seal is pushed into the chamber, it is conductive.

**FIRST!** Each Blackburn Sleeve contains the superior Blackburn inhibitor, Contax, *in measured amount.* Won't squirt out on glove or in face.

LIVE BETTER ELECTRICALLY

**Conductivity of Connection PROVED GREATER Than Equivalent Length of The Conductors Being Connected.**



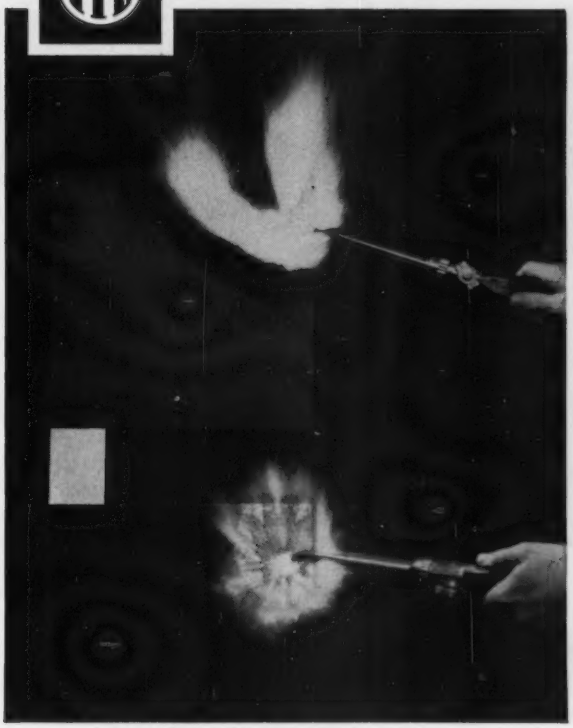

A series of typical current cycling tests were conducted with both ½" x ⅜" diameter BLACKBURN Sleeves. Note the lower resistance of Blackburn Sleeves as compared to the equivalent length of cable without any sleeve.

**Test Conditions**

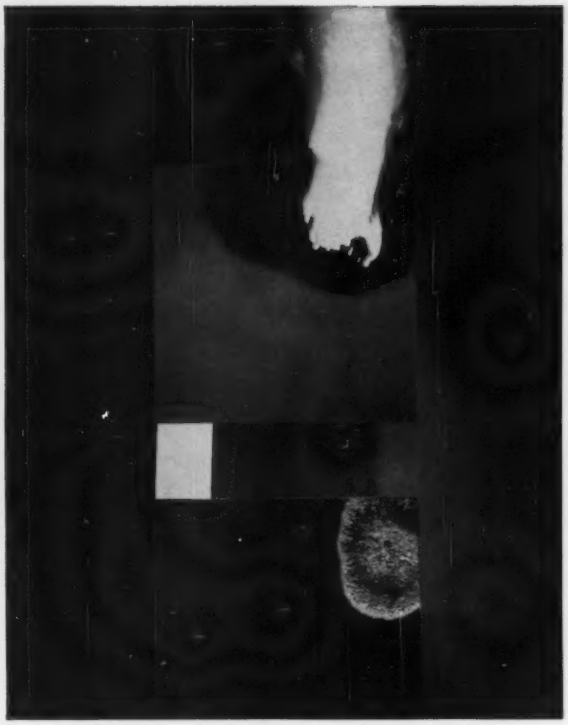
Wire: 2 ACSR to 4 stranded copper
Current: 190 Amperes
Cycle: 2 Hrs. "On" 1 Hr. "Off"
Length of Connection: 24 inches
Curves represent an average of five tests
Resistance of equivalent length of wire: 527 Microhms

**JASPER BLACKBURN CORPORATION,** 1525 Woodson Rd., St. Louis 14, Mo. • WYdown 3-9430

## METAL-CLAD SWITCHGEAR



**TORCHES IGNITE FLAMETRAP** (bottom) and conventional insulation (top) simultaneously.



**SECONDS LATER, FLAMETRAP** has snuffed out, but conventional insulation still burns briskly.

# New FLAMETRAP Insulation Snuffs Out Flame ...No Toxic Gases...Highest Arc Resistance

**FLAMETRAP INTERPHASE BARRIER.** Standard equipment on I-T-E 5 and 15 kv switchgear at no increase in price.

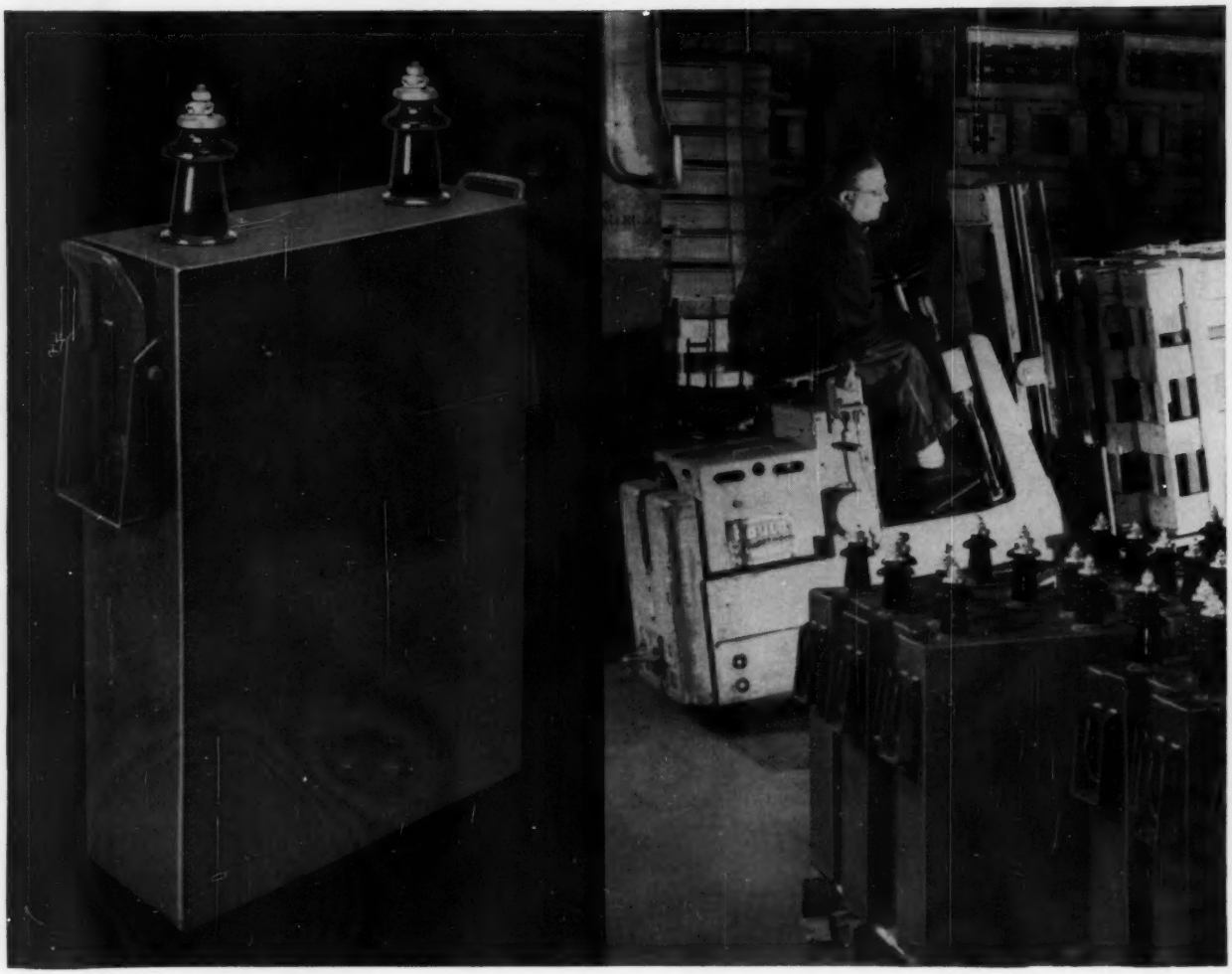
Take the heat away, and this new I-T-E developed **FLAMETRAP** insulation snuffs out . . . fast! This is today's most advanced flame-retardant insulation, and it is used exclusively in I-T-E Switchgear.

**FLAMETRAP** contains melamine resin—heretofore considered too expensive for commercial application. Unlike substitute ingredients, melamine gives off no toxic gases when it burns. So **FLAMETRAP** is far safer. And melamine stands up better under high temperatures. So **FLAMETRAP** suffers less from arc damage.

This latest improvement puts I-T-E switchgear even further ahead of the pack. It is one more of the quality details that keep coming your way from I-T-E without increase in price.

I-T-E service is as near as your telephone or mailbox. Why not call or write today. I-T-E Circuit Breaker Company, Switchgear Division, 19th & Hamilton Sts., Philadelphia 30, Pa. In Canada, Eastern Power Devices Ltd., Port Credit, Ont.

**I-T-E CIRCUIT BREAKER COMPANY**
PHILADELPHIA, PENNSYLVANIA



Another product of Plowback of Earnings into research

# 100-Kvar Capacitors Now Ready for Shipment

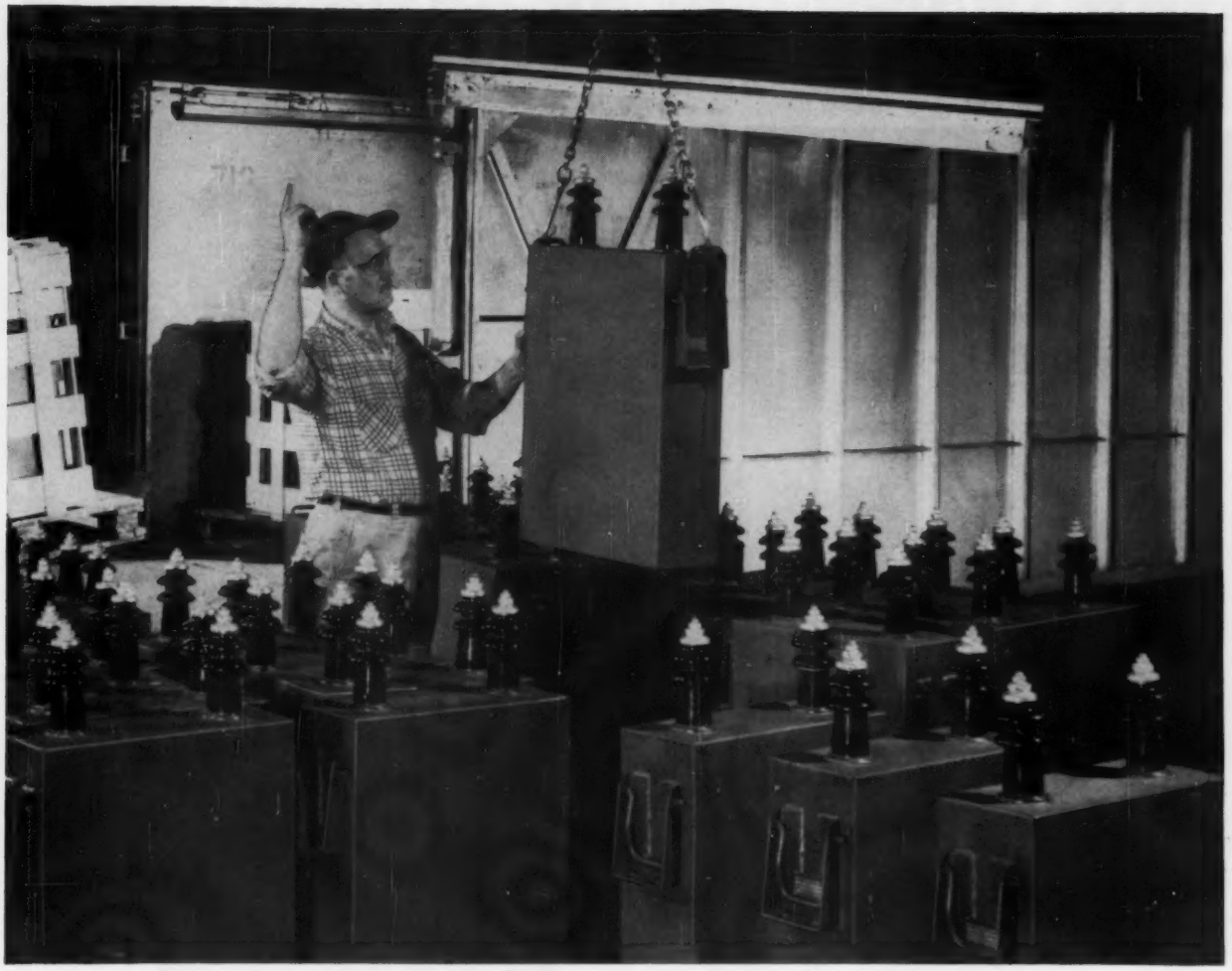
Anticipating the industry's need for larger blocks of reactive power, Westinghouse engineers developed this new 100-kilovar capacitor to boost kvar output per unit . . . *more economically* and conveniently than ever.

These units are in regular production, and shipments are being made to meet the tremendous demand expected for this new product.

Following the long-established policy of reinvestment of earnings for research, these new capacitors feature the high quality and outstanding performance always associated with Westinghouse capacitors. Continual testing during assembly assures top reliability . . . after years of service.

For complete information about the new 100-kvar capacitors and the way they can save you money, call your Westinghouse sales engineer or write to Westinghouse Electric Corporation, P.O. Box 868, Pittsburgh 30, Pa.

J-60951



**Solder-sealed bushings assure hermetic seal.** Complete freedom from leaks or contamination of dielectric is assured. Wet-process porcelain bushings give maximum strength and excellent insulation value.

**Zinc spray finish guarantees maximum protection.** A lifetime corrosion-resistant coat of metallic zinc, sprayed on to a minimum thickness of eight mils, insures unparalleled case life under the most adverse conditions.

YOU CAN BE SURE...IF IT'S Westinghouse

# New residential subdivision gets

**Three** 600v Durasheath Cables were pulled in ducts throughout development.

# underground distribution system

## Electric service is provided by 141,000 feet of Anaconda Durasheath Cable

For one of the South's largest new developments, an entire underground distribution system was installed recently.

The cables: 106,000 feet of Anaconda's 4/0, 1/C 600v Durasheath* neoprene-jacketed cable with Anaconda Type ANW network insulation, and 35,000 feet of #2, 1/C 15kv grounded neutral Durasheath with Type AB butyl insulation.

A good choice! Anaconda's special network and high-voltage butyl insulations give you top moisture and heat resistance, excellent overload protection. Type AB butyl insulation, too, has *inherent* resistance to ozone.

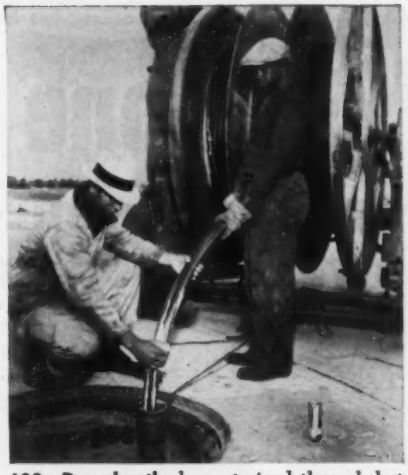
Available in all sizes, single and multiple conductor, copper and aluminum, from 600 to 15,000 volts. Want more information? See the Man from Anaconda or your Anaconda distributor. Anaconda Wire & Cable Company, 25 Broadway, New York 4, N. Y.

*Reg. U.S. Pat. Off. 57360

LIVE BETTER ELECTRICALLY

SEE THE MAN FROM **ANACONDA®**
FOR **DURASHEATH CABLE**

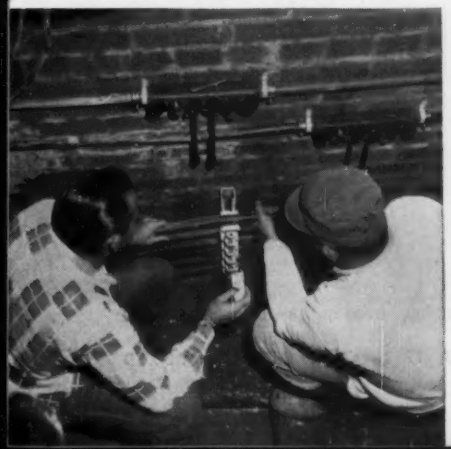
**Each reel** on special electric-powered rig held 400 feet of Durasheath.



**600v Durasheath** shown trained through last manhole to side of transformer vault.

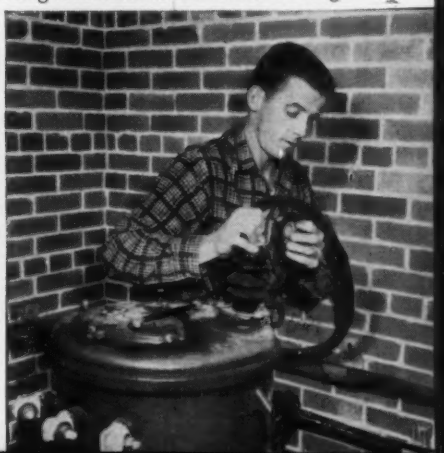
**15kv Durasheath** was likewise pulled into transformer house through duct.

**In underground** vault of substation, cable was trained to the wall.



**In transformer house,** 600v Durasheath was terminated at transformer secondaries.

**In same location,** 15kv Durasheath is shown being terminated at transformer bushings.



# HOW THESE INSTALLATIONS

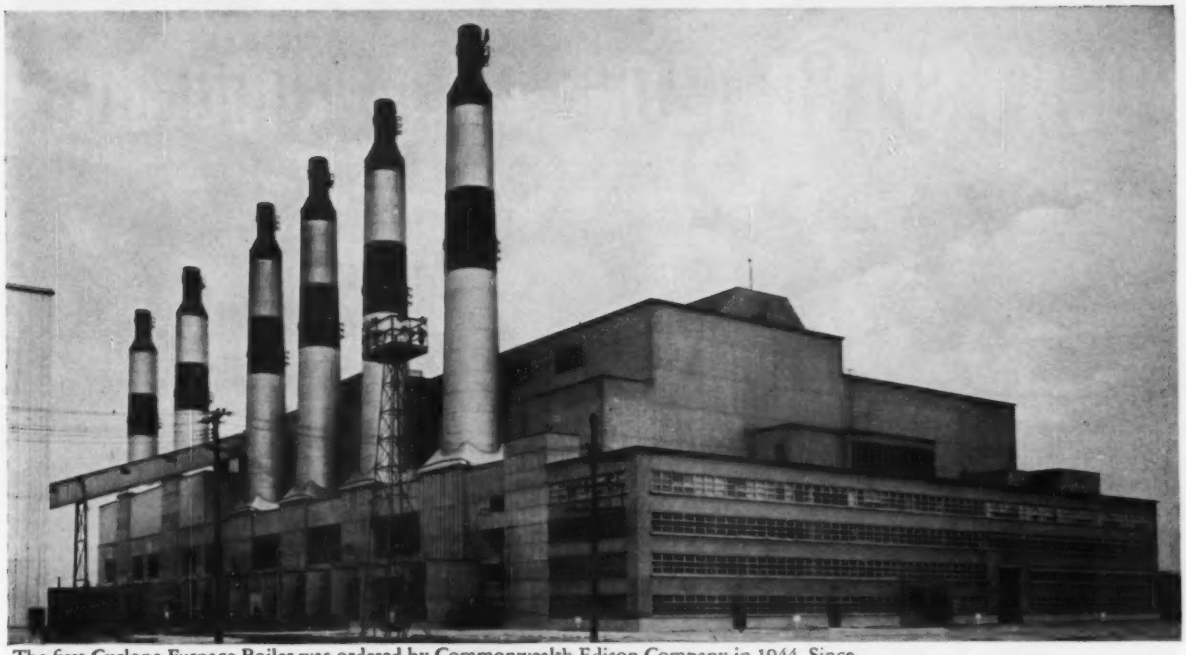
Jersey Central Power & Light Company's E. H. Werner Station. Here the success of the B&W Cyclone Furnace Boiler, the first installed in the East, has led to the purchase of two more boilers.

# The B&W Cyclone Furnace...

## A Modern, Economical Way to Burn Fuel for Power

Niles Station of Ohio Edison Company where two B&W Cyclone Furnace Boilers have been in operation since 1954.

# UTILIZE LOW-GRADE FUELS



The first Cyclone Furnace Boiler was ordered by Commonwealth Edison Company in 1944. Since then this utility has purchased 15 more units, six of them for the Ridgeland Station shown here.

**The B&W Cyclone Furnace simplifies the entire process of coal preparation, combustion, ash handling and ash segregation. Its cost-saving quality contributes to lower fuel costs and reduced maintenance as well as increased operational simplicity, flexibility and safety.**

**Although the B&W Cyclone Furnace operates simply and dependably on either oil or gas, it is particularly effective in utilizing inexpensive, low-grade coals. Its rapid combustion burns the coal more completely and operates with low excess air. Most of the ash is melted to slag right in the Cyclone Furnace, where it is easy to handle and dispose of. The slag cleaning and fly-ash problems so prevalent with other types of firing are consequently alleviated.**

**Many other modern advances in combustion and high-pressure, high-temperature steam generation are available through B&W. Write for further information today. The Babcock & Wilcox Company, Boiler Division, 161 East 42nd Street, New York 17, N. Y.**

G-882

BABCOCK & WILCOX

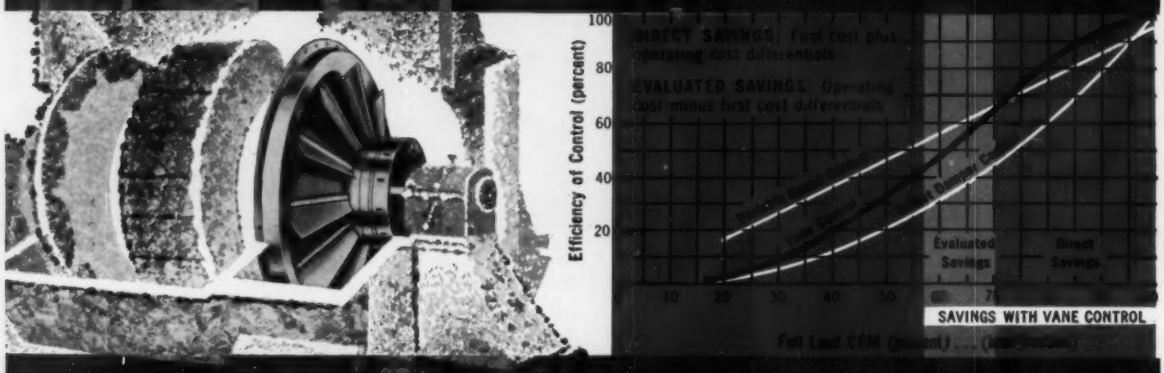
BOILER DIVISION

**PURCHASERS OF THE B&W CYCLONE FURNACE**

| FOR CENTRAL POWER STATIONS | Number of Cyclone Furnace Boilers |
|---|---|
| Atlantic City Electric Co. | 1 |
| Baltimore Gas & Electric Co. | 1 |
| Chilena de Electricidad | 2 |
| Columbus & Southern Ohio Electric Co. | 2 |
| Commonwealth Edison Co. | 16 |
| Consumers Public Power District (Nebraska) | 1 |
| Detroit Edison Co. | 1 |
| Indiana & Michigan Electric Co. | 1 |
| Jersey Central Power & Light Co. | 3 |
| Memphis Light, Gas & Water Division | 3 |
| Middle South Utilities, Inc. | 1 |
| Missouri Public Service Co. | 1 |
| Monongahela Power Co. | 1 |
| Northern Indiana Public Service Co. | 3 |
| Ohio Edison Co. | 2 |
| Ohio Power Co. | 6 |
| Public Service Co., of New Hampshire | 1 |
| Tampa Electric Co. | 3 |
| United Illuminating Co. | 2 |
| Wisconsin Power & Light Co. | 4 |
| **FOR INDUSTRIAL INSTALLATIONS** | |
| American Cyanamid Co. | 1 |
| American Enka Corp. | 1 |
| Columbia Southern Chemical Co. | 1 |
| Consolidated Water Power & Paper Co. | 1 |
| Dow Chemical Co. | 5 |
| Eastman Kodak Co. | 1 |
| Greenwood Mills | 1 |
| International Paper Co. | 4 |
| National Container Corp., of Wisconsin | 1 |
| Rhinelander Paper Co. | 1 |
| St. Croix Paper Co. | 1 |
| Thilmany Pulp & Paper Co. | 1 |
| West Virginia Pulp & Paper Co. | 1 |
| **Total** | **75** |

# DON'T SPEND $12,000 ON A $4,000 JOB

## and still lose money on operating costs!




**Westinghouse Inlet Vane Air Spin Control**
**is the best way to regulate forced and induced draft fan volume with constant speed motors**

## * Lower First Cost * Lower Operating Costs * High Efficiency

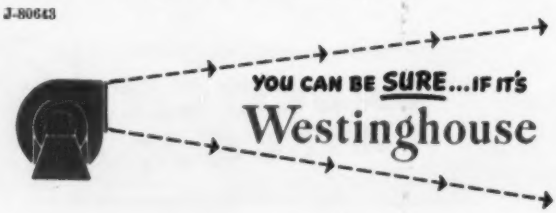
Specify this simple, reliable and mechanically foolproof regulator of fan output for your combustion control. Action is smooth. Response to exact pressure and volume requirements is instantaneous, adjustment precise.

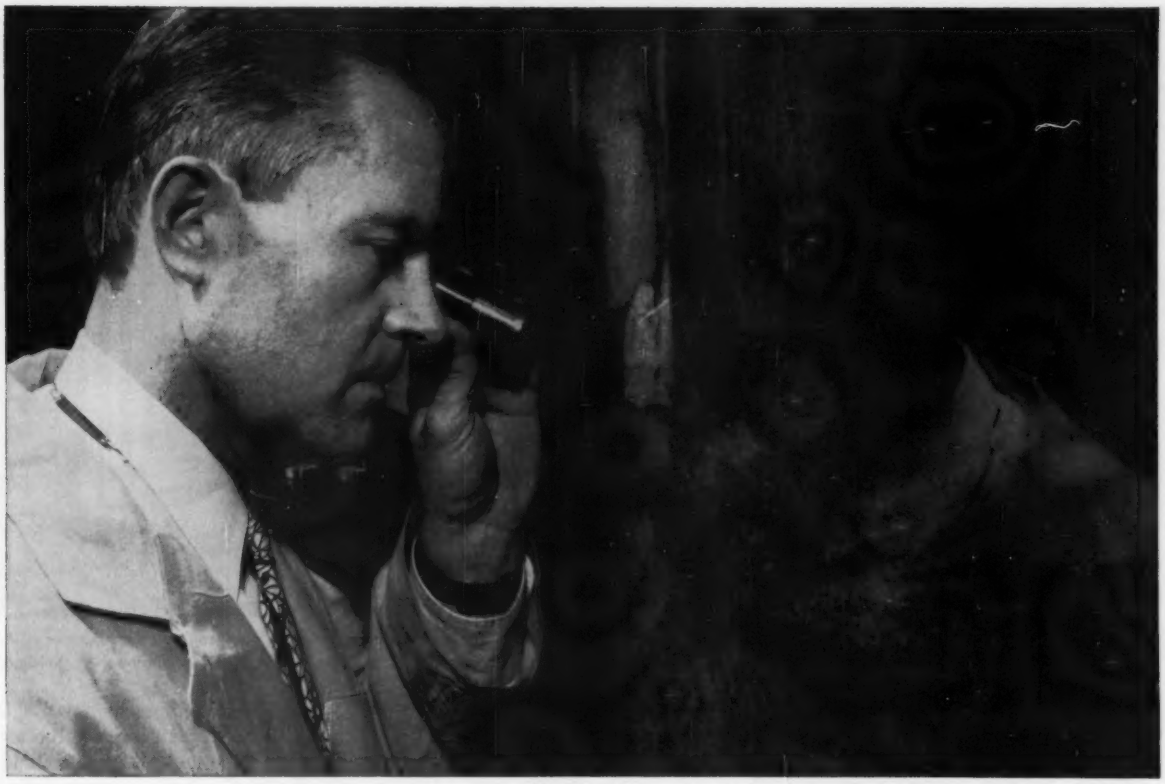
*Westinghouse Vane Control can be used on Forced and Induced Draft!* Available in distinct designs for clean air forced-draft and coal-fired induced-draft applications.

Hundreds of power plants are benefiting from the economy and effectiveness of Westinghouse Inlet Vane Control on Forced and Induced Draft Fans.

Call your local Sturtevant Division Sales Engineer today, or write Westinghouse Electric Corporation, Dept. A-15, Hyde Park, Boston 36, Massachusetts.

J-80643





**Termite colony** under glass at new research laboratory of United States Steel.

# We have termites—so you won't

**Termites attack untreated wood**—pressure-creosoted wood repels termite attack.

Solid black indicates heavy incidence of termites; dark gray, heavy to moderate; and light gray, slight to moderate.

**There's a colony of termites** working for United States Steel in our new research laboratory. One of our scientists located them in an old stump near one of our test plots in Mississippi. Now their habits are being studied to find out what makes creosote such an effective protection against these destructive insects.

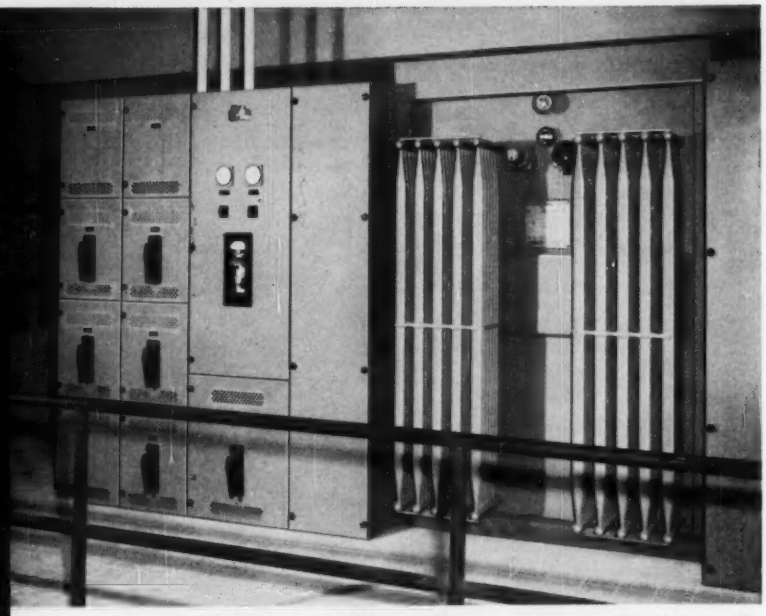
Termites are found in every state in the union, with heavy infestations as far north as Wisconsin and Massachusetts (see map). They eat and digest ordinary untreated wood and soon attack wood that has been merely dipped or coated. But the deep penetration of pressure creosoting offers lasting protection against termites and other wood destroying organisms. Pressure-creosoted poles and timbers have averaged 35 years of life in many localities.

Pressure creosoting should be looked upon as low-cost insurance. Its advantages and economies are thoroughly proved. For more information on pressure treatment and USS Creosote—the quality preservative—write United States Steel, 525 William Penn Place, Pittsburgh 30, Pa., or call the nearest United States Steel Chemical Sales Office.

Chemical Sales Offices in Pittsburgh, New York, Chicago, Salt Lake City and Fairfield, Alabama

USS Creosote

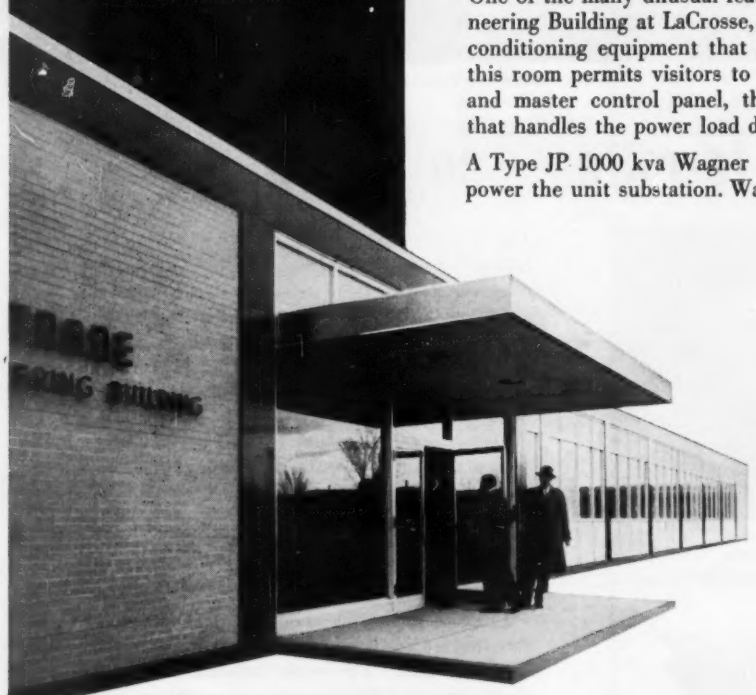
# WAGNER Close-Coupled Transformer permits compact load-center for TRANE COMPANY



This Wagner 1000 kva Noflamol close-coupled Transformer is installed in Trane Company's new $1,250,000 Engineering Building.

One of the many unusual features of The Trane Company's new Engineering Building at LaCrosse, Wisconsin, is a display room for the air conditioning equipment that serves the building. A full glass wall in this room permits visitors to view the Trane CenTraVac water chiller and master control panel, the pump room and the unit substation that handles the power load distribution for the building.

A Type JP 1000 kva Wagner close-coupled transformer was chosen to power the unit substation. Wagner close-coupled transformers fit flush against the switchgear enclosures, eliminating throats and saving space. Connections are made at the bushings on the sides of the transformer. Bushing heights are designed to give ample room for connection to switchgear or busses and eliminate need for special throats to match special switchgear. These noninflammable liquid-filled transformers are available in ratings from 500 through 2000 kva.



Consult your nearby Wagner Sales Engineer about the complete Wagner line of Unit Substation Transformers—both liquid-filled and dry-type. Bulletins TU-205 and TU-214 give full information on Wagner Unit Substation Transformers for industrial power needs. Write for your file copy today.

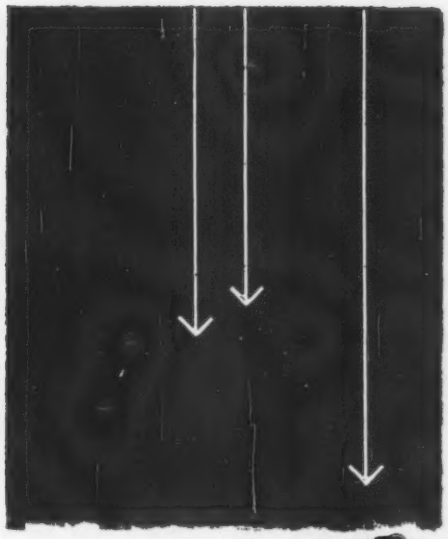
Wagner Electric Corporation
SERVING INDUSTRY SINCE 1891

WT58-2

BRANCHES AND DISTRIBUTORS IN ALL PRINCIPAL CITIES

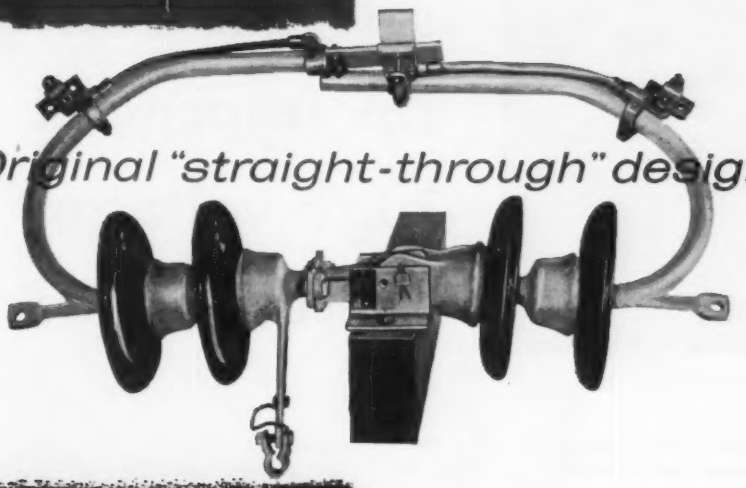
Wagner Electric Corporation
6456 Plymouth Ave., St. Louis 14, Mo., U.S.A.

ELECTRIC MOTORS • TRANSFORMERS • INDUSTRIAL BRAKES • AUTOMOTIVE BRAKE SYSTEMS—AIR AND HYDRAULIC

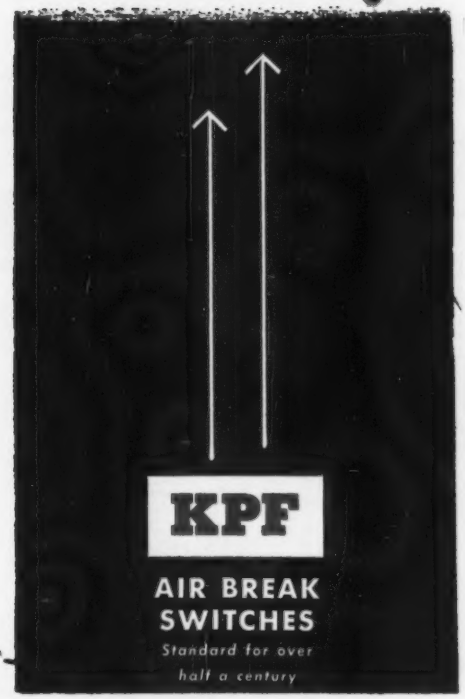


# Only KPF switches look like this

**simple, attractive, trouble-free, proved in 50 years service**



*..... Original "straight-through" design .....*

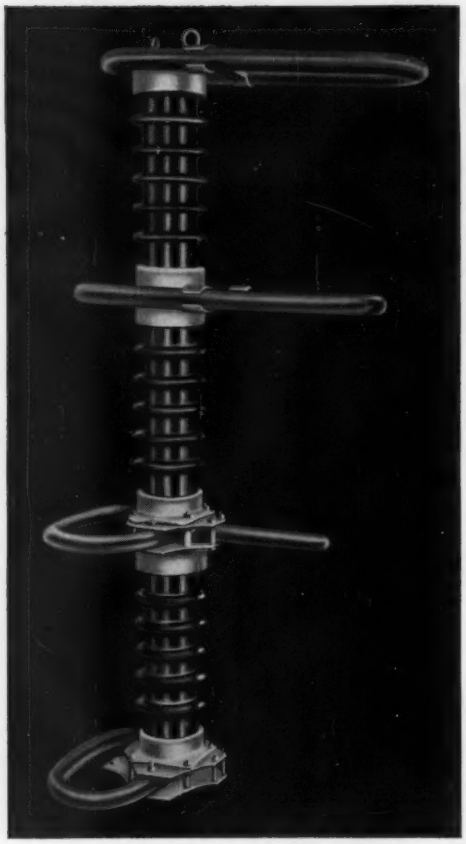



You always know when a power company is using KPF switches. (As more and more are today). You can't miss the clean, functional "straight-through" appearance of KPF phase units. This same design simplicity that produces pleasing pole top appearance also insures all-weather operating ease. KPF switches have no temperamental mechanisms to malfunction, freeze, lock, need lubrication or wear out.

KPF switches have proved their dependability in over 50 years service on major utilities. Make a test installation of the original, "straight-through" air break switch on your system this month.

Write direct for catalog.

**KPF ELECTRIC COMPANY**
**Dept. E. 1624 E. Alpine Avenue**
**Stockton 5, California**



330-kv device used in field tests

# Westinghouse PLOWBACK of earnings provides another new tool for improved high-voltage system operation

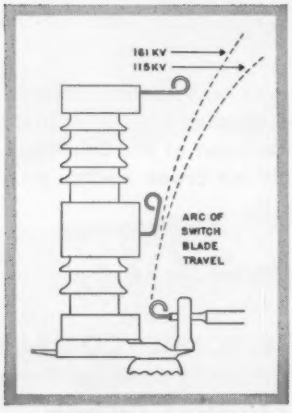
Here is a practical device that eliminates harmful surges on high-voltage systems during no-load operation of disconnecting switches.

Over the years, there have been numerous cases of unexplained equipment failures during switching operations that Westinghouse engineers now have the answer to — thanks to the Company's cooperative investigations with several large utilities in the high-voltage field (330 to 500 kv).

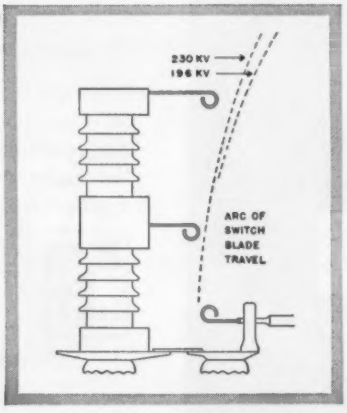
Surges that caused these heretofore unexplained equipment failures can be controlled by the resistor devices now available for addition to Westinghouse Type V horizontal base-mounted air-break switches 115 through 330 kv.

For complete information about the new resistor device, call your Westinghouse sales engineer or write Westinghouse Electric Corporation, P.O. Box 868, Pittsburgh 30, Pennsylvania. J-60950

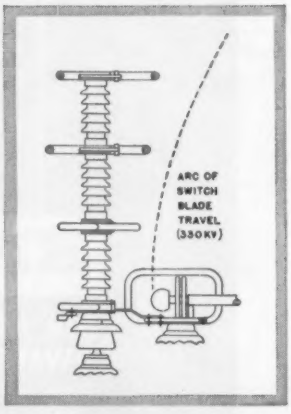
YOU CAN BE SURE...IF IT'S Westinghouse




Device for 115-161-kv Type V




Device for 196-230-kv Type V




Device for 330-kv Type V

J. VAN SOMER, SALES MANAGER AND CHIEF

# HOW ANCHOR HELPED SOLVE A PROBLEM IN FORT WORTH

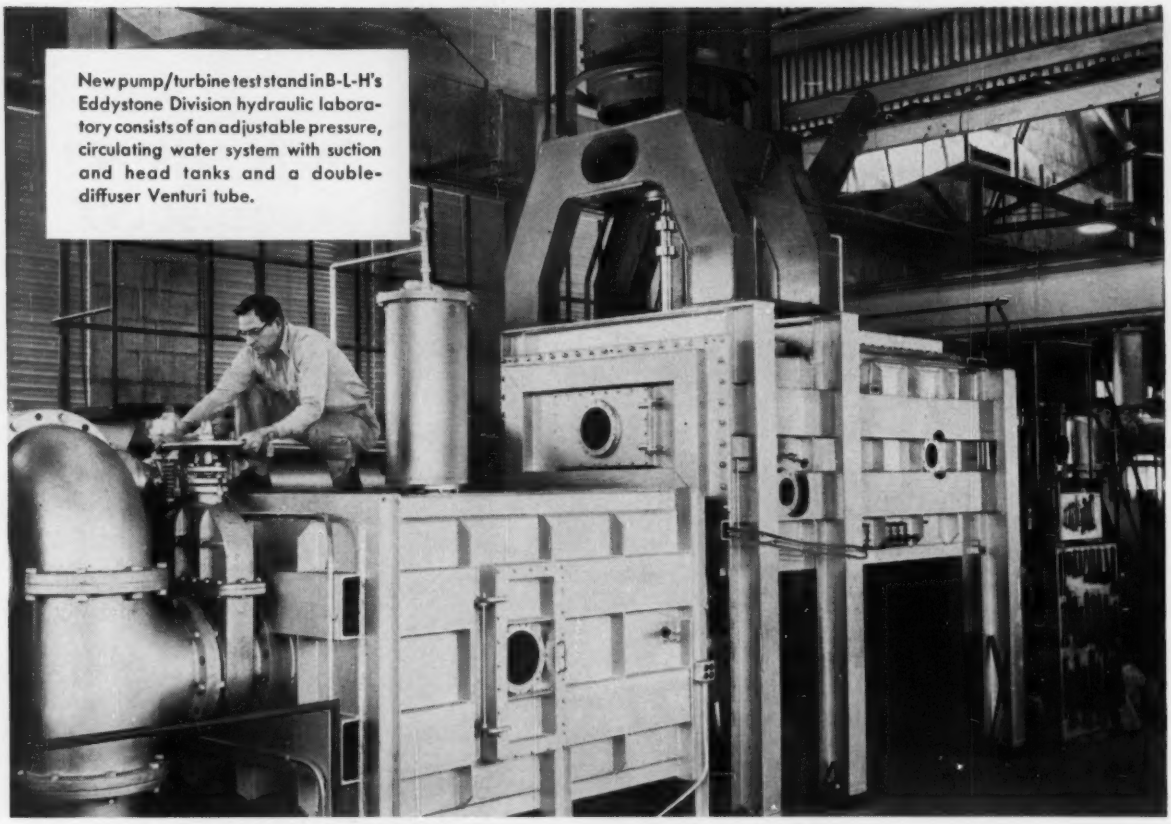
The Texas Electric Service Company has a sub station in a new residential area. The only right of way location not prohibitive in cost was a narrow space between a highway and a railroad right of way.

Anchor designed and tested a four-foot square tower to carry the same loading as a broad base tower. And the line went through.

*At Anchor, service and quality is the slide rule of every operation.*

ANCHOR METALS INC.

HURST, TEXAS • FORT MADISON, IOWA



New pump/turbine test stand in B-L-H's Eddystone Division hydraulic laboratory consists of an adjustable pressure, circulating water system with suction and head tanks and a double-diffuser Venturi tube.

# New equipment enables B-L-H to test pump/turbine models as a turbine or pump under full range of operating conditions

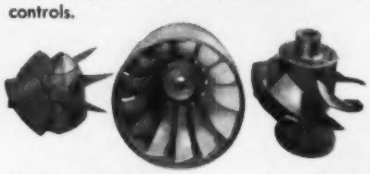
At its Eddystone Division hydraulic turbine laboratory, Baldwin-Lima-Hamilton is able to test a model both as a turbine and a pump under a complete range of operating conditions without changing the hydraulic setup. With this equipment, B-L-H is accumulating research results that will result in better designed pump/turbines and consequent narrowing of the gap between pumping energy expenditures and power generation.

The new facilities consist essentially of a circulating water tunnel with a double-diffuser Venturi tube which measures flow in either of two directions. Two butterfly valves are provided so that movement is always throttled downstream from the Venturi. A 100-hp dynamometer atop the head tank measures turbine and pump power. Water pressure is measured by manometers.

At its Eddystone Divison, B-L-H continuously conducts tests on Kaplan, Francis and fixed-blade propeller type turbines. Impulse turbine testing is carried on in the laboratories of the Pelton Division, San Francisco.

For specific information about our products and services, write to B-L-H Corporation, Philadelphia 42, Pa., or Pelton Division (B-L-H), 2929 Nineteenth Street, San Francisco 10, Calif.

Control panel for pump/turbine test stand includes dynamometer instruments and valve controls.



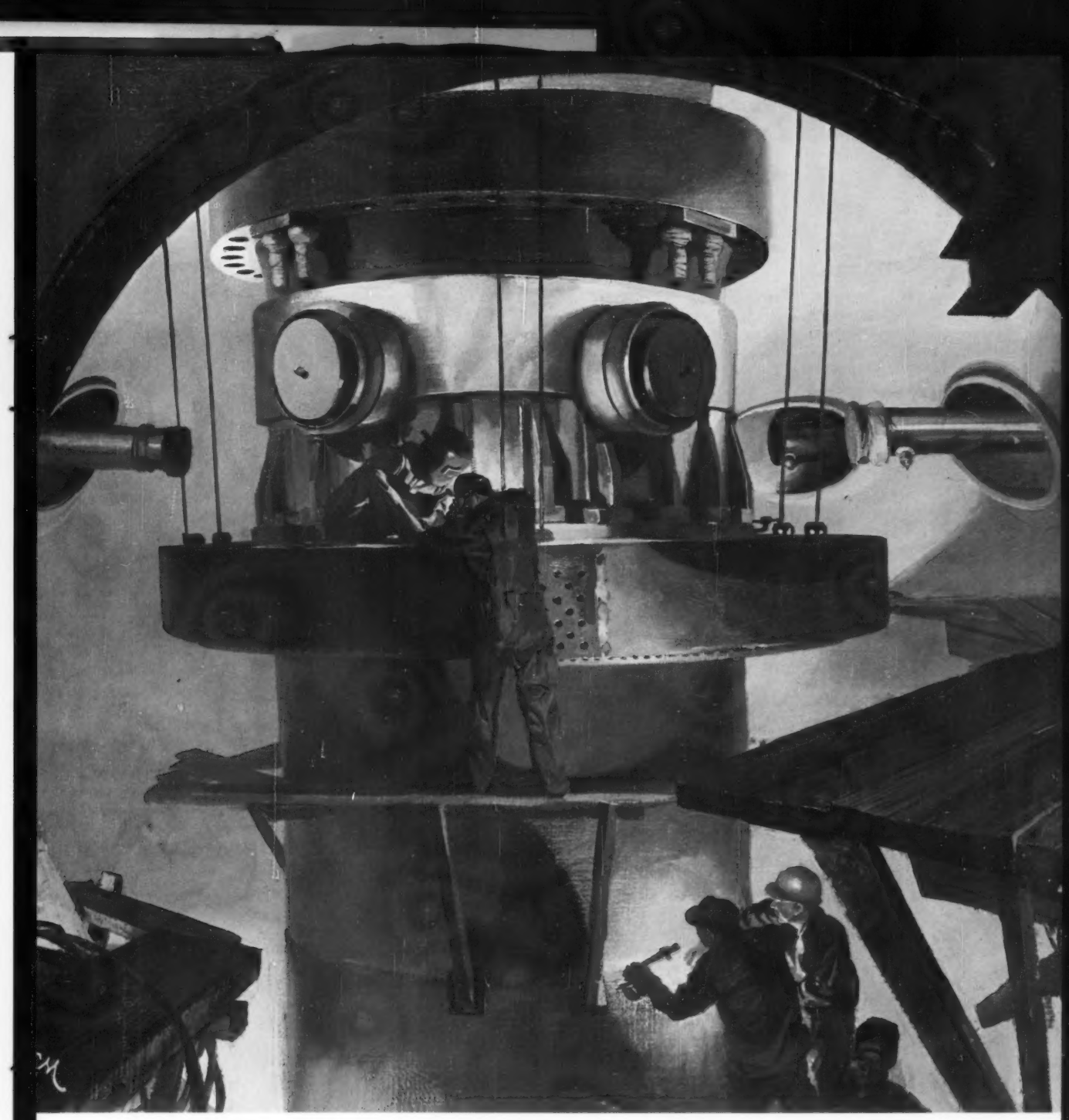
Models of Kaplan, Francis and fixed-blade propeller type runners used for testing purposes at the Eddystone Division hydraulic lab.

**BALDWIN · LIMA · HAMILTON**

Eddystone Division

Philadelphia 42, Pa.

Hydraulic turbines • Weldments • Dump cars • Nonferrous castings • Special machinery • Bending rolls • Machine tools



## Electricity from the atom...controlled by cables jacketed in neoprene

Massive yet clean and simple in its design, this huge casing contains uranium fuel elements—the heart of America's first full-scale nuclear-powered electric generating plant. The plant is located at Shippingport, Pa., and is operated by the Duquesne Light Company.

Behind the scenes lie the stories of thousands of design and engineering decisions that led to this scientific achievement. Many of these decisions involved specifications for the cables used in both the generation and distribution of power.

Providing this cable was the job of cable producers who worked closely with the utility and equipment manufacturer in the crucial selection of types, constructions and installation. For example, over 50,000 feet of control cable is used in the plant. For all of it, Du Pont neoprene was chosen as the jacketing material—to insure long-term, dependable performance of the vital control network.

*How this versatile synthetic rubber is being used to help cable producers meet the electrical industry's growing wire and cable needs is reviewed on the following pages.* →

# HERE'S HOW CABLE PRODUCERS USE
# MEET POWER DEMANDS THAT

**New constructions last longer,**

**Buried Cable—Baltimore.** Baltimore Gas & Electric Company buried two 35-kilovolt cables to feed power from a substation to a nearby industrial plant. By burying the cable directly in the ground, the company saved substantially on installation costs. Neoprene jacketing made it possible because it protects the lead sheath from corrosion.

**Triplex Cable—Texas.** Texas Power & Light Company uses over a million feet of neoprene-covered cable a year to meet its power demands. This cable does not get stiff and unmanageable in winter nor does the neoprene flow in extreme summer temperatures.

**Transformer Cable—Philadelphia.** At its Wynnewood, Pa., substation, Philadelphia Electric Company uses 38-kilovolt cables as transformer leads. The cables are protected from deterioration by water, ozone and weather with extruded neoprene jacketing. Neoprene has protected many Philadelphia Electric cables for as long as 11 years.

# NEOPRENE TO HELP UTILITIES DOUBLE EVERY 10 YEARS

## speed installation, improve performance and reduce maintenance costs

**Submarine Cable—St. Louis.** Four lead-sheathed cables were laid under the Mississippi River to carry power from Union Electric Company's Cahokia, Ill., plant to St. Louis, Mo. The neoprene covering provides a resilient cushion between the lead sheath and the steel wire armor. Neoprene also reduces galvanic corrosion and the effects of vibration, bending and strain.

**Overhead Cable—Kansas City.** Kansas City Power & Light Company uses a unique cable—the "Kansas City Service Drop"—for pole-to-home installations. It's made of two aluminum conductors covered with neoprene and wrapped in aluminum ribbon. It reduces contact hazard to employees and customers, is easy to string through trees, and withstands the abrasion of tree trunks and limbs.

**Control Cable—Detroit.** At Detroit Edison Company's River Rouge Power Plant 800,000 feet of single and multi-conductor cable are used to operate the plant's control system. All cable is jacketed with neoprene. This utility standardized on Du Pont neoprene jacketing because of its unusual resistance to flex cracking, oil, ozone, aging and flame . . . important factors that contribute to safety, dependability and long life.

Electric power consumption has doubled and redoubled in the past 20 years. To meet this demand, utilities, equipment manufacturers and cable producers have made tremendous improvements in the generation and distribution of electricity. As these pictures show, there is a great variety of uses for cable. And each requires a *different* type to meet specific conditions of service.

Selecting the right cable for a job can mean great savings to a utility since cable installation is a long-term investment. That's why the most efficient electrical service systems are usually the result of joint effort by the utility and the cable producer in the *planning* stage.

For over 20 years, one factor has been common to many types of cable—jackets of neoprene. Even though a few other rubbers match some of neoprene's qualities, and some are lower in cost, this Du Pont synthetic rubber has been the most widely used resilient jacketing material. Why? Because no other resilient material made offers the *combination* of useful properties found in neoprene, nor its established history of dependable, long-term service.

On these two pages are illustrated some of the many types of cable now jacketed with neoprene. On the following page is further evidence of neoprene's ability to withstand time and the elements.

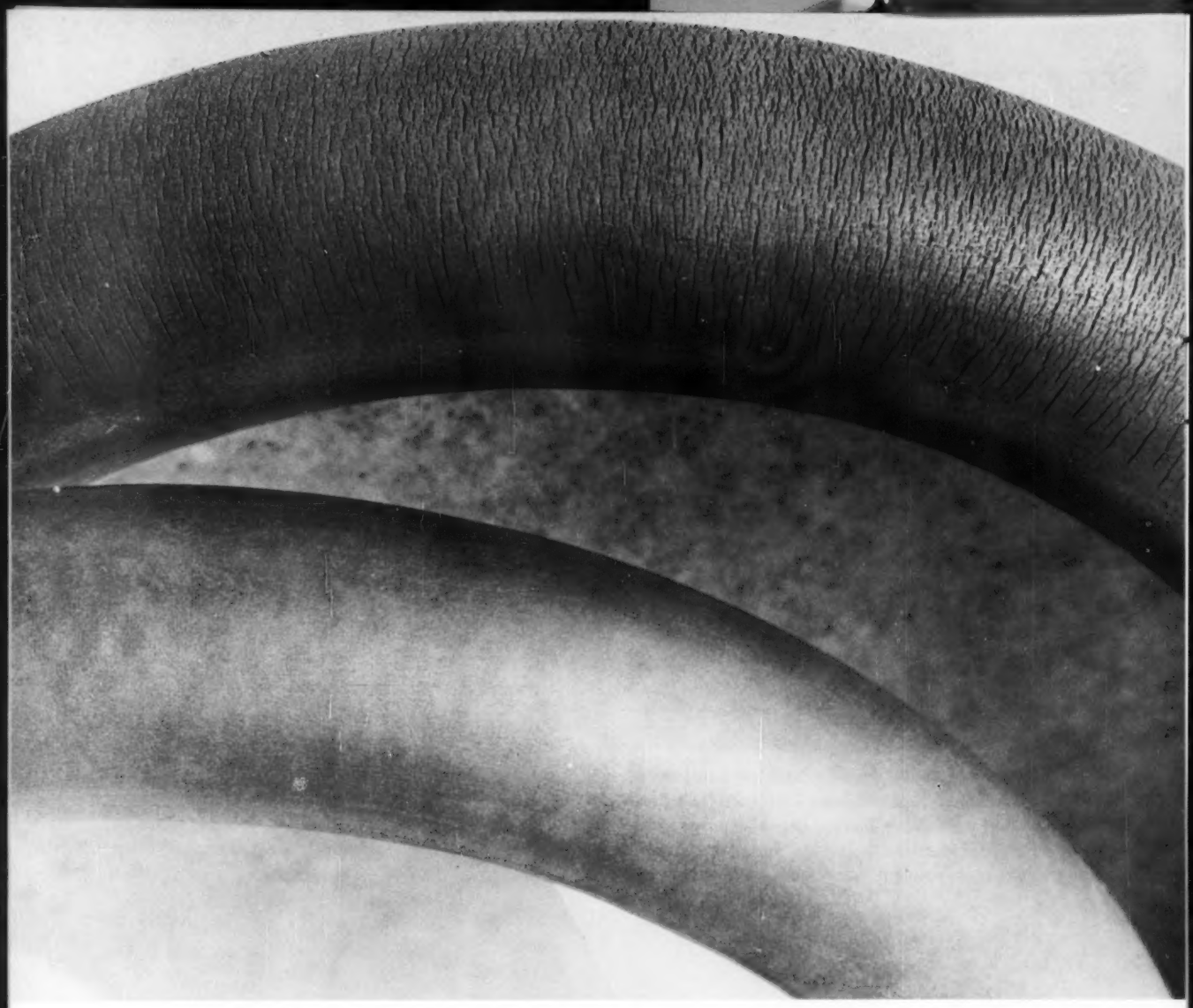
→

***DU PONT ELASTOMERS IN ACTION***

DU PONT

REG. U. S. PAT. OFF.

**Better Things for Better Living**
***. . . through Chemistry***



## This 23-year test proves neoprene's reliability

In January, 1935, these two samples were placed in test by a major cable producer at the company's outdoor proving ground. These unretouched photographs (taken in December, 1957) tell the story. The neoprene sample is still lively and tough after 23 years' exposure. No cracks have appeared. No deterioration is visible. Compare this durability to the natural rubber sample. It is badly cracked and has almost no physical strength.

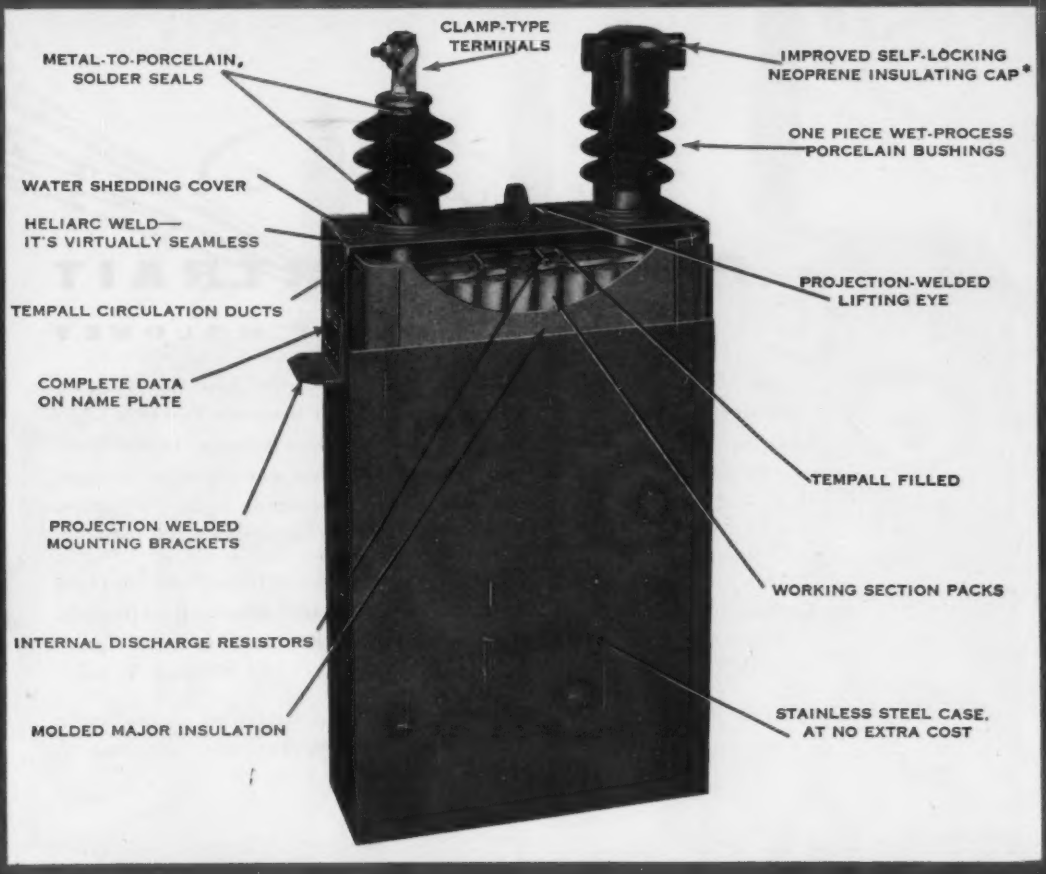
This ability to withstand aging, sunlight and weather as well as the ravages of oil and grease, chemicals, flex cracking, heat, oxidation and abrasion is unique to neoprene. And neoprene will not support combustion. It's the only resilient material that combines such a balance of so many properties. That's why neoprene-jacketed cable is specified by so many utility companies today.

Ask your supplier about wire and cable jacketed with neoprene. It's available in single and multiple conductor types and voltage ratings to meet your requirements. Write for regular free copies of the ELASTOMERS NOTEBOOK with actual on-the-job reports of neoprene's performance in a wide range of industrial products. A request will put your name on the free mailing list. E. I. du Pont de Nemours & Co. (Inc.), Elastomer Chemicals Department EW-3, Wilmington 98, Delaware.

DU PONT
REG. U. S. PAT. OFF.

**BETTER THINGS FOR BETTER LIVING . . . *THROUGH CHEMISTRY***

## TOBE invites you to look inside the capacitors...




BEFORE YOU BUY A HOUSE, you look a lot farther than the color of the bathroom tile. You find out how the house is really constructed!

It's smart to be just as thorough when you buy capacitors. Here are other TOBE features which assure efficiency and long life in TEMPALL CAPACITORS:

- *Constant quality control of individual units during manufacture, processing and tests.*
- *Each unit visually inspected during manufacturing cycle to insure complete impregnation and oil-fill.*
- *Special TOBE assembly control mechanism results in greater product uniformity.*

Because of low losses resulting from TOBE'S advanced engineering design and manufacturing technique you get more correction for your capacitor dollar. This too means more capacitor efficiency for less money.

That's why it will pay you to investigate TOBE capacitors today. Available in all standard ratings. In single units, racks, pole assemblies and complete cabinets ready for field installation and energization. Write Tobe Deutschmann Corporation, Norwood, Massachusetts or phone Norwood 7-2620, collect for further information today.

*LOOK TO TOBE FOR PROGRESS*

**Since 1929 persistent research, trustworthy engineering, rigid production standards.**

TOBE

TEMPALL CAPACITORS

*PATENT PENDING

# POWER PORTRAIT

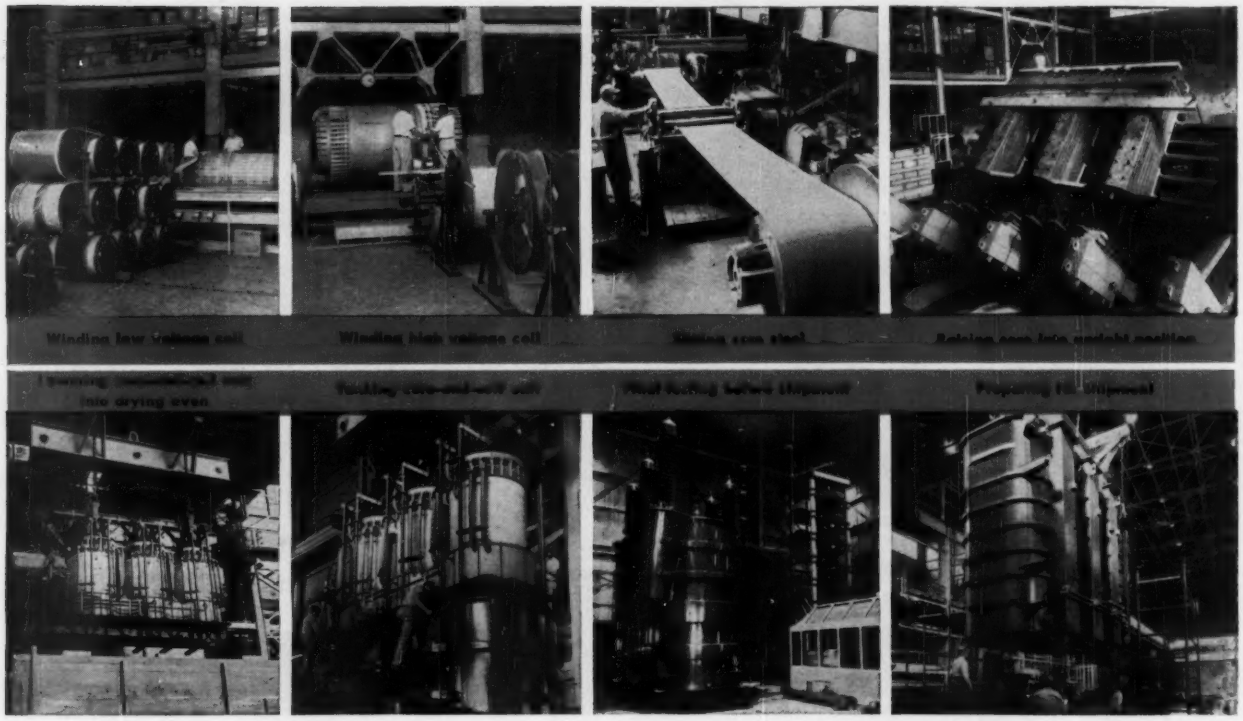
BY MOLONEY

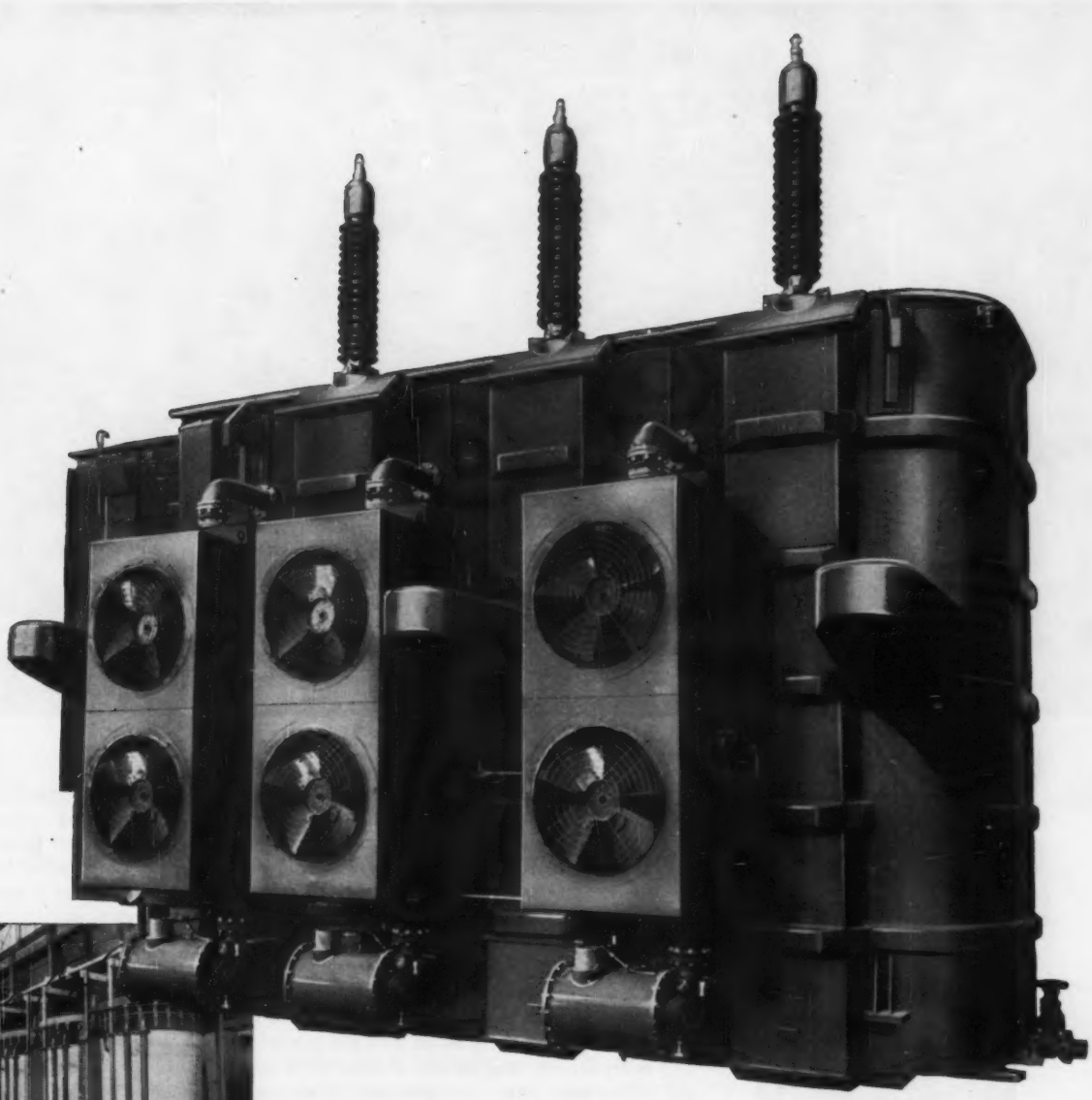
**A 100,000 K. V. A.,** three phase, forced-oil-cooled, load tap changing transformer recently completed by Moloney for the Iowa Power & Light Company. **High voltage: 161,000 Grd. Y. volts. Low voltage: 14,400 Delta volts.** Equipped with load tap changing equipment to obtain voltages 5% above and 5% below rated high voltage in eight 1¼% steps. All voltages are full capacity.

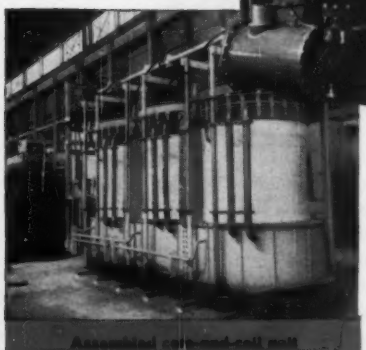
MR87-23

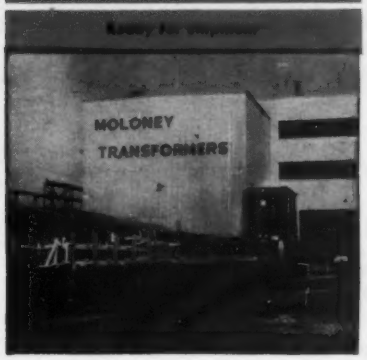
This is the main power transformer for Unit #2 at Iowa Power & Light Company's Council Bluffs Power Station. The transformer will step-up the generated voltage of 14,400 delta volts to the transmission voltage of 161,000 Grd. Y. volts.

Another example of Moloney's ability to design and manufacture transformers of any rating to meet their customers specific requirements.










MOLONEY ELECTRIC

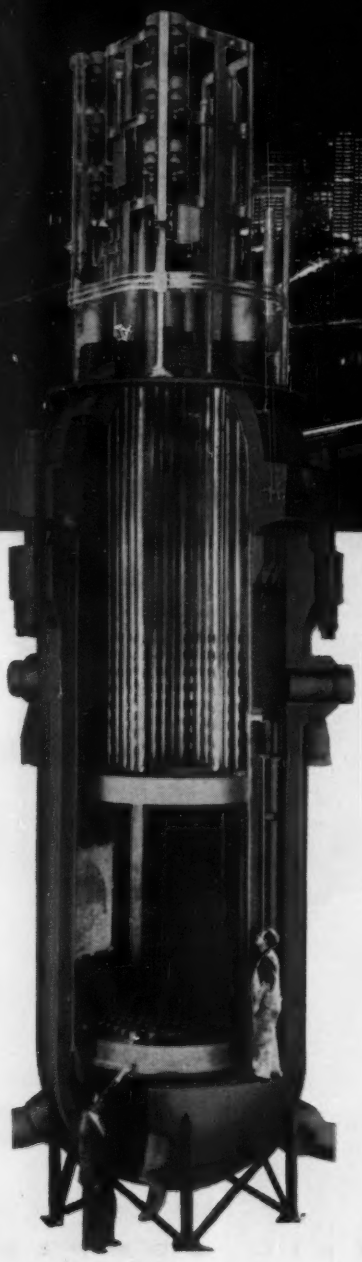
**MOLONEY ELECTRIC COMPANY**

*Manufacturers of Transformers for Utilities, Industry and Electronic Applications*

SALES OFFICES IN ALL PRINCIPAL CITIES • FACTORIES AT ST. LOUIS 20, MISSOURI, AND TORONTO, ONT., CANADA

# Atomic Power...

## — comes to Pittsburgh



Full-scale cutaway model of 4-story high Shippingport reactor. The reactor vessel, indicated by the colored areas, was designed and built by Combustion. Model made for Westinghouse by Gardner Displays.

Today, commercial electric power from the atom is a reality in America. On December 2, 1957, the country's first full-scale atomic power plant... the Shippingport Station operated by the Duquesne Light Company...went critical. It began producing power December 18 and reached full power output 5 days later. Designed by Westinghouse Electric Corporation for the Atomic Energy Commission, this pioneer nuclear power plant is now in regular operation, supplying electricity to the Pittsburgh area.

Combustion Engineering was one of Shippingport's major suppliers. Its contribution: the heaviest unit of atomic power equipment ever built... the 235-ton reactor vessel—depicted by the colored areas in the picture opposite. This mammoth container houses the nuclear fuel charge within 8½-inch steel walls. More than 3½ tons of water pass through the vessel every second—at pressures of about 2,000 pounds per square inch—to carry off the tremendous heat generated by the nuclear reaction. Though it stands over three stories high, many of its massive parts were machined to watchmakers' tolerances. Entirely new fabrication and inspection techniques had to be developed to make such precision possible.

Combustion's activity in the field of nuclear power has ranged from such civilian projects as Shippingport and the Fast Breeder Reactor vessel for the Enrico Fermi Plant* to the design and manufacture of a complete submarine reactor system and numerous components for our nuclear Navy. C-E's highly specialized personnel and extensive facilities for nuclear work will enable the Company to occupy as important a place in the future use of atomic fuels as it has long held in the field of conventional power generation.

*Designed by Atomic Power Development Associates, Inc. for operation by Power Reactor Development Company

**COMBUSTION ENGINEERING**

Combustion Engineering Building
200 Madison Avenue, New York 16, N. Y.

C-147

ALL TYPES OF STEAM GENERATING, FUEL BURNING AND RELATED EQUIPMENT; NUCLEAR REACTORS; PAPER MILL EQUIPMENT; PULVERIZERS; FLASH DRYING SYSTEMS; PRESSURE VESSELS; SOIL PIPE

Westinghouse

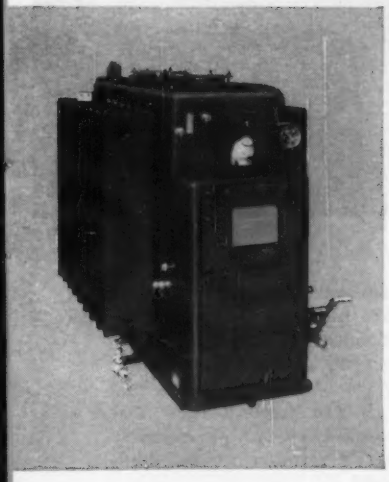
# SPACE-MISER

## NETWORK TRANSFORMER

This is a modern design network transformer produced to the exacting requirements of modern network systems. It provides high utilization kva together with greater reliability, reduced maintenance and simplified inspection. It affords the reserve ability necessary for emergency operating conditions. The SPACE-MISER, with its greatly reduced size, is made possible through advanced engineering, materials and manufacturing techniques developed by Westinghouse Transformer Division.

*FIRST WITH THE FUTURE*

# THE DECAL TELLS ALMOST THE FULL STORY



The decal reproduced above is applied to every Westinghouse SPACE-MISER network transformer. It tells almost the full story . . . almost—but not quite. What it doesn't tell is that:

The new SPACE-MISER has been reduced *12 inches* in height —it can now be mounted off the floor of the vault.

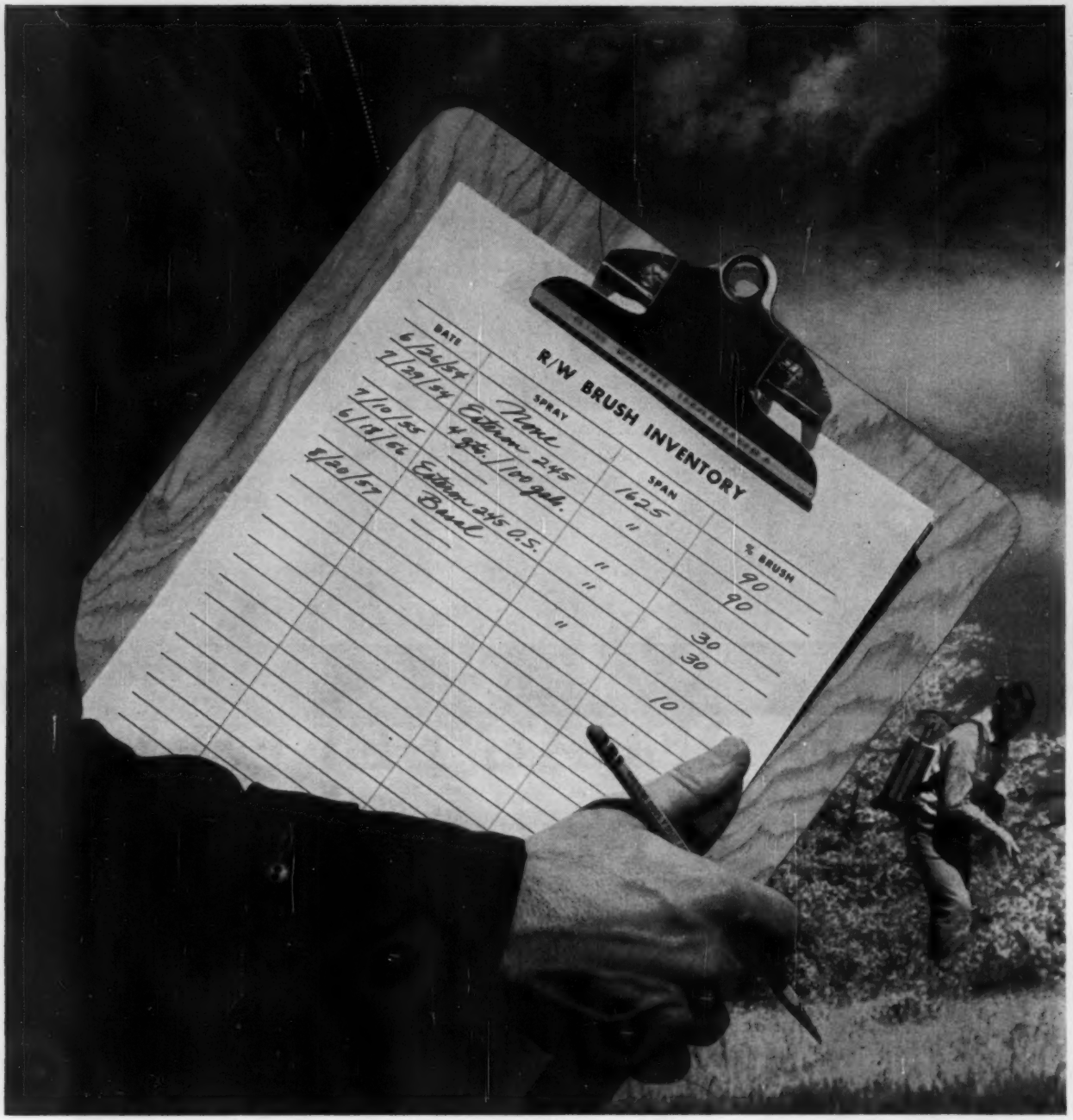
The new SPACE-MISER weighs *20% less*—installation is easier, faster; handling is safer.

The new SPACE-MISER occupies *15% less* vault space—less cramped vaults mean easier maintenance.

The SPACE-MISER is another example of how Westinghouse Plowback of Earnings—into research . . . and development of better materials with more efficient utilization of existing materials—produces the improvements that set the pace in helping electric utilities keep electricity America's biggest bargain.

You can get the full story of what the SPACE-MISER offers for *your* network operations by calling your Westinghouse sales engineer . . . J-70854

YOU CAN BE SURE...IF IT'S Westinghouse




Utilities are getting the word. Chemicals control brush and weeds better, more economically, than axes and cutting equipment. Cost-conscious utilities can show you yearly cost figures that prove it. In fact, records show that chemical control cost gets progressively smaller, while maintenance standards are improved.

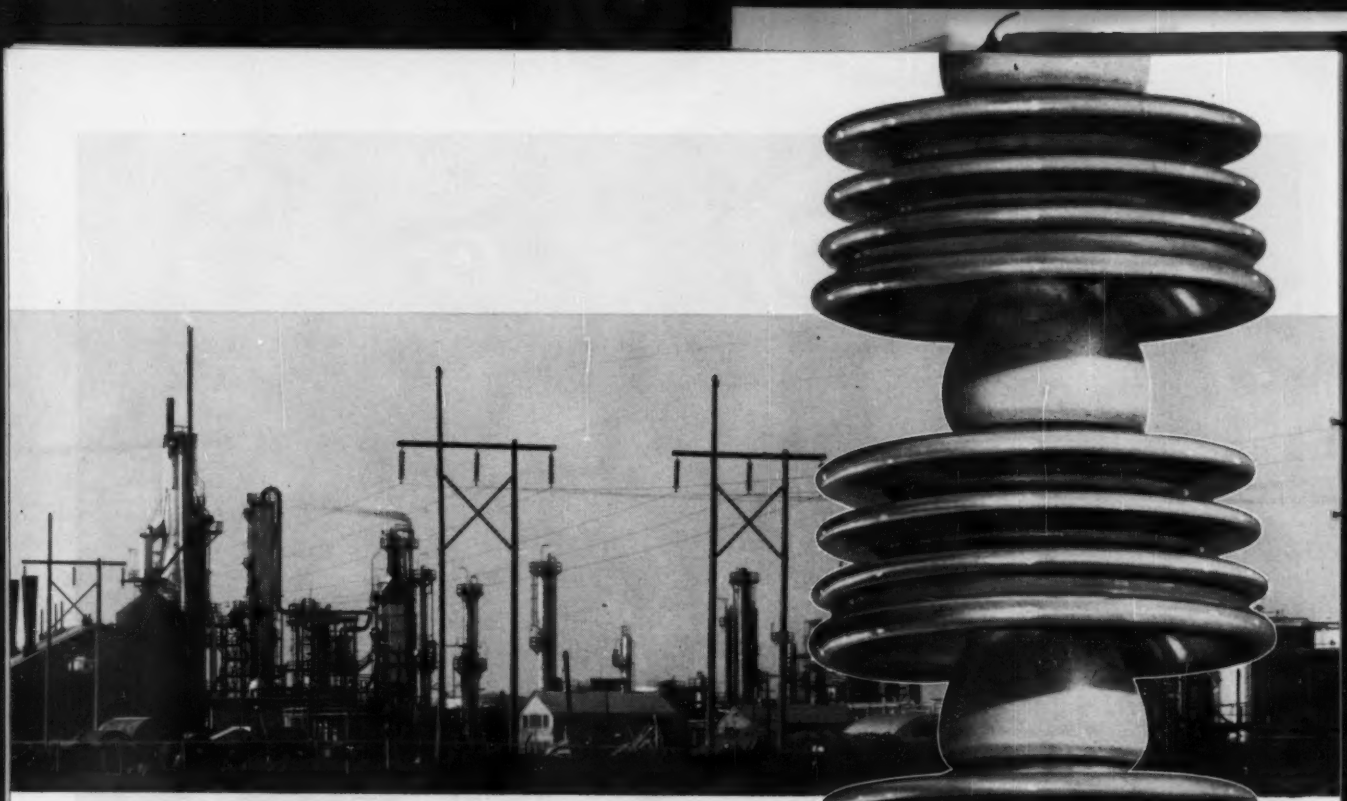
# Keep right-of-ways clean and clear for 50% less ... *with Dow Brush and Weed Killers*

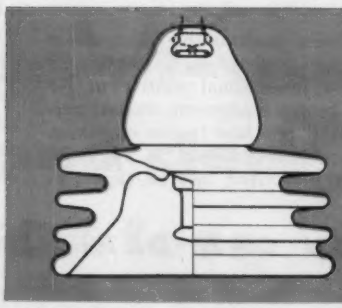
A trained crew, using Dow brush and weed killers, can often cut maintenance costs in half. And there's a proven Dow product for every brush and weed problem. Esteron* 245 O.S. knocks out a wide range of resistant hardwoods. Kuron* gives complete kill on maple, oak and hard-to-kill woody plants. And newly developed Veon* 100 for brush and weed control in crop area is safer, efficient, easy to use.

When you're studying the maintenance job on your right-of-ways, be sure to consult a professional contractor. He has the proper equipment, trained personnel and know-how to give maximum brush and weed control at minimum cost per mile. And he's an expert in the selection of the right Dow chemical for the maintenance job at hand. We'll be pleased to send you the name of a professional contractor upon request. Write today for the new booklet "Planned Vegetation Control Program For Utilities". THE DOW CHEMICAL COMPANY, Agricultural Chemical Sales Department, Midland, Michigan.

*TRADEMARK

YOU CAN DEPEND ON DOW





*Standard-strength (15,000-lb.) Lapp Fog-Type suspension unit for 5¾" or 6½" spacing either ball-socket or clevis type*

*High-strength (25,000-lb.) Lapp Fog-Type suspension unit for 5¾" or 6½" spacing either ball-socket or clevis type*

# *Contaminated atmosphere?*
# USE LAPP FOG-TYPES
## THE DESIGN WITH 33 YEARS OF SUCCESSFUL SERVICE

Industrial fumes, salt-spray, dust, even automotive exhaust, continually coat your transmission lines with a conductive deposit. Where these conditions are excessive, prevention of insulator flashover becomes a prime operating and maintenance problem.

Lapp Fog-Type insulators offer a complete answer. Their design (a Lapp innovation more than 30 years ago) provides extra length of leakage path—and a *uniform* leakage path. Maximum exposure to contamination . . . to wetting . . . to cleaning action of wind and rain—distributes voltage evenly, prevents leakage flashover. Even in most areas of severe atmospheric contamination, Lapp Fog-Types require no cleaning—where they do, cleaning intervals are longer, and cleaning easier than on other types.

Forward utility thinking now calls for use of Fog-Type insulation on *all* lines in sea-shore or urban locations; it pays off in improved service records and lowered maintenance costs. And the specification of Lapp Fog-Type Suspension Units adds an extra margin of operating security and trouble-free long life.

Lapp Insulator Co., Inc., Le Roy, N. Y.

**Lapp**

# THE PEACEFUL ATOM

## ...takes a big step forward

### Formal Dedication of the Sodium Reactor Experiment Marks Significant Milestone in Nuclear Power Program

On November 14, 1957, in a building high in California's Santa Susana Mountains, a group of people witnessed a ceremony of great significance not only to America, but to mankind everywhere. What they saw was the official confirmation of the success of the sodium graphite type of nuclear reactor as a most promising new method of increasing resources of usable power in a power-hungry world.

They were watching the formal dedication of the Sodium Reactor Experiment, designed and built for the Atomic Energy Commission by Atomics International. The SRE includes an experimental atomic power reactor, which achieved sustained nuclear fission in April, 1957. In July reactor heat was used to generate electricity. The SRE has been performing as planned, supplying data on the practical aspects of designing and operating a power station based on the Sodium Graphite Reactor. The power produced by the SRE is being delivered for use to the homes and factories of the nearby San Fernando Valley. It was the first electricity ever to be supplied to the American public by a private utility from a non-military nuclear reactor.

NUCLEAR-POWERED SPARK
A switch is thrown at the dedication of the Sodium Reactor Experiment—and electricity from the atom surges into the lines of a private utility company.

THE ATOM GOES TO WORK IN SOUTHERN CALIFORNIA
In the rugged Santa Susana Mountains near Los Angeles, the Sodium Reactor Experiment is showing great promise as a practical source of electric power.

#### Basis for Large Power Stations

Atomics International designed the SRE to give a maximum output of about 6500 electrical kilowatts. This nuclear power plant is now in operation as part of the Atomic Energy Commission's program to develop efficient types of reactors to meet the growing worldwide need for power. Atomics International will use data from the SRE to design and construct large power stations like the 75,000 kilowatt plant planned for the Consumers Public Power District of Nebraska.

The Southern California Edison Company cooperated with Atomics International by providing a generating plant to turn the nuclear reactor heat energy into electricity and by distributing the power to its customers.

#### Other Achievements by AI

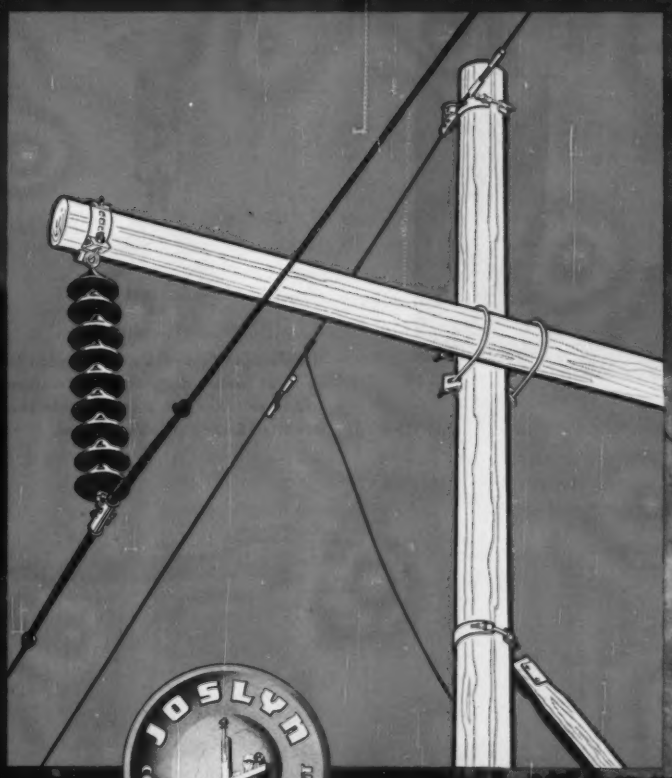
Another nuclear power approach being conducted by Atomics International for the Atomic Energy Commission is the Organic Moderated Reactor Experiment in Idaho, which has been operating since last September. This project will provide technical information for the construction of two 12,500 kw power stations—one in Piqua, Ohio; the other in a Latin American country. AI recently completed a study for the AEC's Maritime Reactors Branch which indicated that the OMR has technical and economic promise as a power plant for atomic supertankers and merchant ships.

Another power reactor concept, the Advanced Epithermal Thorium Reactor, is under study for the Southwest Atomic Energy Associates. AI research reactors are now operating in Japan, Germany, Denmark, and the United States. Others are being built for Italy and West Berlin.

ATOMICS INTERNATIONAL, P.O. Box 309, Canoga Park, California. Cable Address: ATOMICS.

**ATOMICS INTERNATIONAL**
A DIVISION OF NORTH AMERICAN AVIATION, INC.
PIONEERS IN THE CREATIVE USE OF THE ATOM

# COMPLETELY BANDED TRANSMISSION STRUCTURES



Use of Joslyn Banded-Type Transmission Hardware results in—

1. Greater strength by eliminating pole gains and bolt holes.
2. More uniform surface distribution of leakage current.
3. Reduced probability of damage from lightning flashovers.
4. Easier assembly because of interchangeable fittings and elimination of pole framing.
5. Greater flexibility of structure design because of fewer standard parts.
6. Simplified purchasing and material handling because of unframed poles and spars.

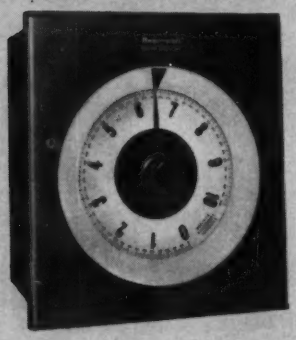
*Photograph is of line in service for over 10 years.*

JOSLYN

MFG. AND SUPPLY CO., 155 North Wacker Drive, Chicago 6, Illinois

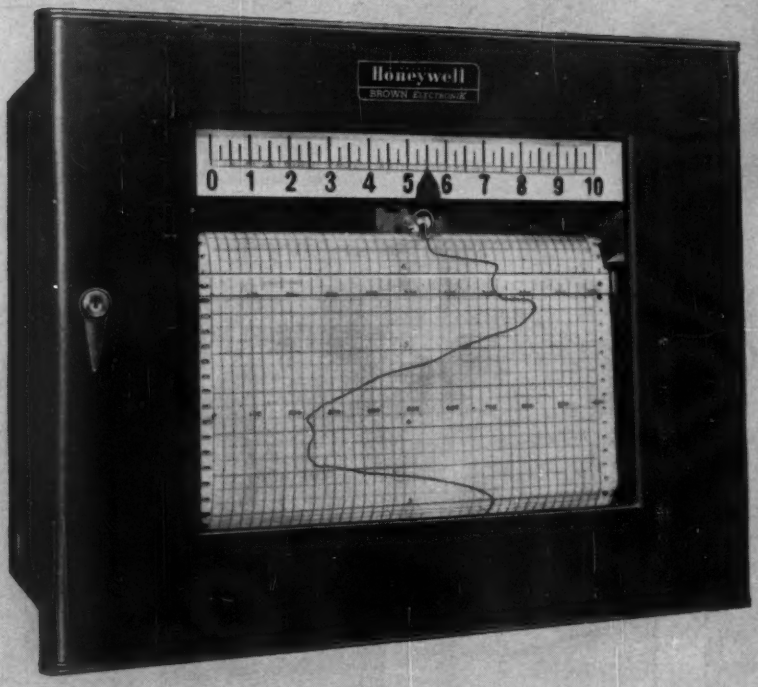
Circular Chart Recorder . . . Has large 28″ indicating scale, is available with electric or pneumatic control. Extremely accurate and dependable.

Precision Indicator—Vertical Scale . . . Has drum-type, power-driven scale. Full scale travel in 12 or 4½ seconds.



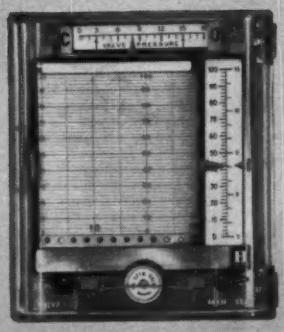
Circular Scale Controller . . . Scale is over 2½ feet long. Set point index rotates with scale for 12 o'clock control check. Available in all electric control forms.

# From



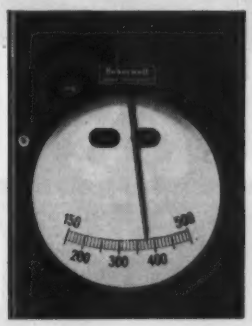

Strip Chart Recorder—Single or Multiple Point . . . Records all types of variables. With either print wheel or pen. Choice of pen speeds and chart speeds.

Diaphragm Control Valve—Series 800 . . . For heavy duty service. In standard sizes from 1 to 8-inch single seated—to 12-inch double seated.

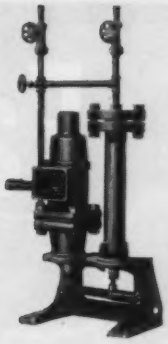


*Tel-O-Set* Miniature Recorder . . . Designed for graphic panels. Has automatic-manual unit, remote set-point adjustment and vertical indicating scale, and horizontal-scale valve pressure gage.

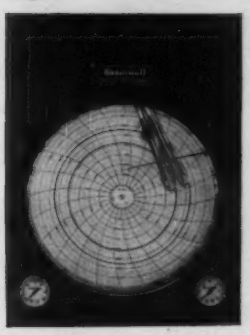
*Differential Converter* Transmitter . . . Highly responsive to rapid changes in flow, has continuously adjustable span requiring no change of parts over a 10-to-1 range.



Indicating Thermometer or Pressure Gage . . . Has 7½" eccentric type scale. Available with a variety of pressure sensing elements.



Mercury Meter Body—Electrical or mechanical, square root or evenly graduated.



Recording Controller . . . For temperature, pressure, flow, liquid level, etc. Wide choice of control systems. Available with electronic integration to totalize flow.

# ONE Source...

# instrumentation

## ...for your every need

Let Honeywell take care of *all* your instrumentation needs. From this one dependable source—the world's largest maker of automatic controls—choose exactly what you need, from a line of instruments as broad as your requirements.

Whatever you want to measure or control—temperature . . . pressure . . . conductivity . . . pH . . . flow . . . load and frequency—you'll find precisely the right instruments in Honeywell's complete line.

You can be sure that equipment suggested for your plant is recommended without bias.

With a complete line there's no need to over-sell or under-equip. And when you get all your instrumentation from a single source, you enjoy the important advantage of undivided responsibility by Honeywell for the complete installation.

Your nearby Honeywell field engineer will be glad to discuss your needs. Call him today . . . he's as near as your phone.

MINNEAPOLIS-HONEYWELL REGULATOR CO., *Industrial Division*, Wayne and Windrim Avenues, Philadelphia 44, Pa.

# Honeywell

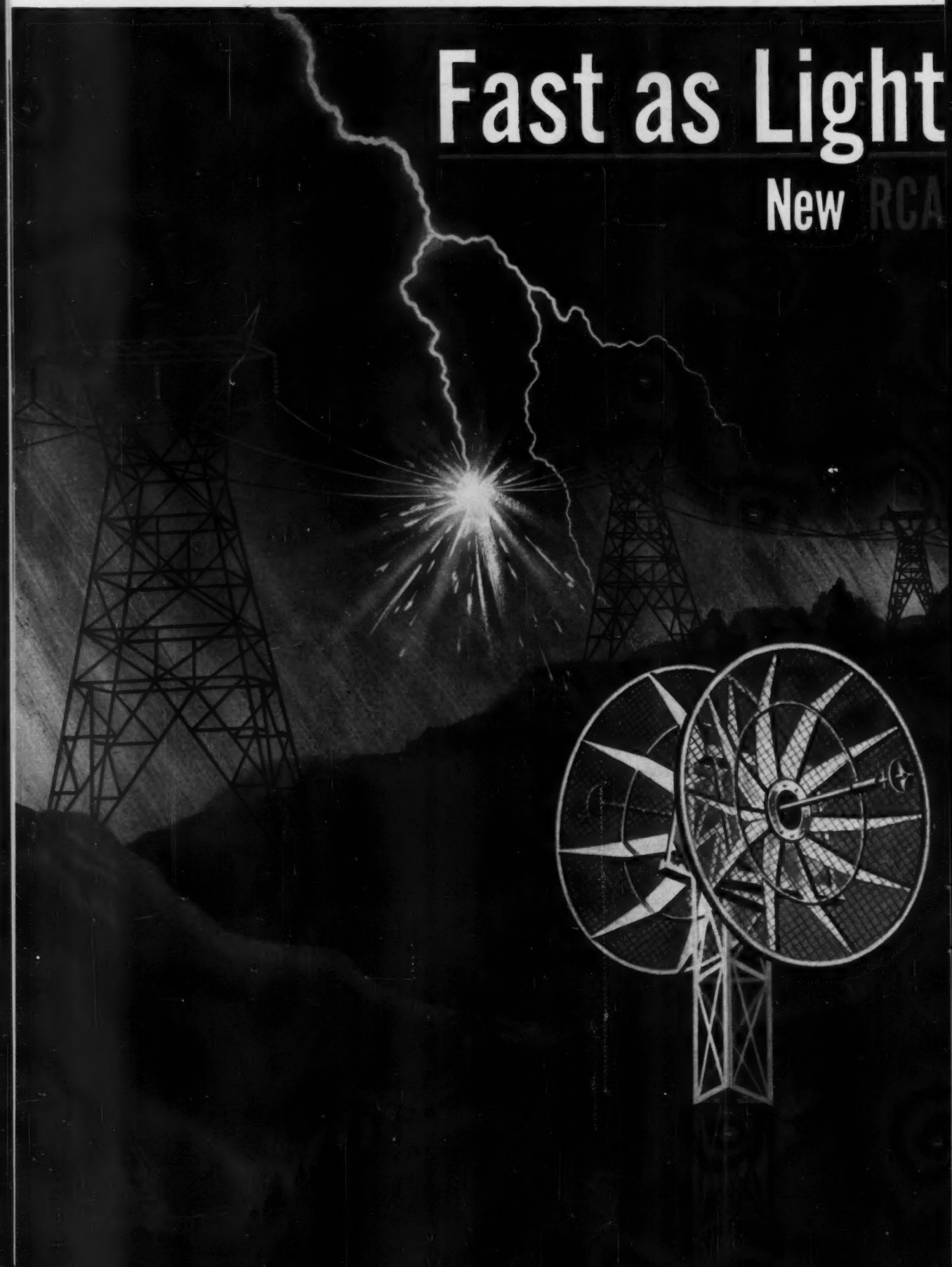
H HONEYWELL

*First in Controls*

OVER A MILLION CHANNEL MILES OF

# Fast as Light

## New RCA

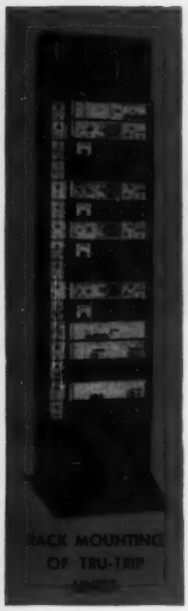


RCA MICROWAVE NOW IN SERVICE

# ning Strikes

## TRU-TRIP Actuates Transfer Tripping System

### ...helps assure safe operation at near peak capacity



Power line faults—mechanical failures or circuit overloads caused by lightning or other physical damage — must be isolated in less than 1/10th of a second to minimize service disruption and prevent widespread loss.

**Action in 1/100th of a Second**

In only 1/100th of a second, RCA TRU-TRIP initiates vital transfer-tripping safety action by transmitting an alarm signal which triggers the proper combination of circuit breakers to isolate the damaged line.

**A Unique "Circuit Sentry"**

TRU-TRIP is a *transistorized* tone transmission device which instantly reacts to protect faulty high-voltage power lines when alerted by the standard fault-sensing relays of an electric power transmission system.

**Extends Reliability of Protective Relaying**

As a result of complete transistorization and use of guard tones to prevent false tripping, RCA TRU-TRIP provides a marked increase in the over-all reliability of protective relaying networks.

**Low-Cost Protection of Large-Capacity Systems**

In conjunction with protective relaying equipment, RCA TRU-TRIP gives low-cost protection of large-capacity transmission systems, since as many as 44 protective tone channels can be transmitted simultaneously...or on special order, as many as 160.

**Operates with Microwave or Wireline**

Use RCA TRU-TRIP with either wireline or microwave radio relay systems. Microwave is unaffected by adverse weather, has no cables which can be short-circuited, operates independently of power lines.

**Battery-Operated, Easy to Install**

Compact and easy to install, TRU-TRIP units require so little power they can operate directly from a substation battery. And they can be installed in quantity to protect all terminals of a high-voltage system. Each transistorized TRU-TRIP transmitter or receiver unit occupies only 3½ inches of a standard 19-inch rack, or 75% less space than required by comparable tube-type equipment.

***RCA Microwave Systems*** provide commercial users with many important features: Operation in the most advantageous frequency bands, low installation cost, and minimum maintenance. Designed to exacting RCA standards, and integrated with dependable VHF mobile radio, these systems have established significant records for continuous uninterrupted service and performance in public utilities, gas and petroleum pipelines, cross-country highways and government agencies. By turning over entire responsibility for a communications project to RCA, you can cut corners and relieve your own personnel of all details in connection with an installation.

*You will want to find out more about this important contribution to protective relaying. Complete illustrated brochure available. Use coupon below for quickest service.*

Tmk(s) ®

**RADIO CORPORATION of AMERICA**

COMMUNICATIONS PRODUCTS

CAMDEN, N. J.

**Radio Corporation of America**
**Communications Products**
**Department D-45, Building 15-1, Camden, N. J.**
**In Canada: RCA VICTOR Company Limited, Montreal**

☐ Please send me new illustrated brochure on RCA TRU-TRIP.

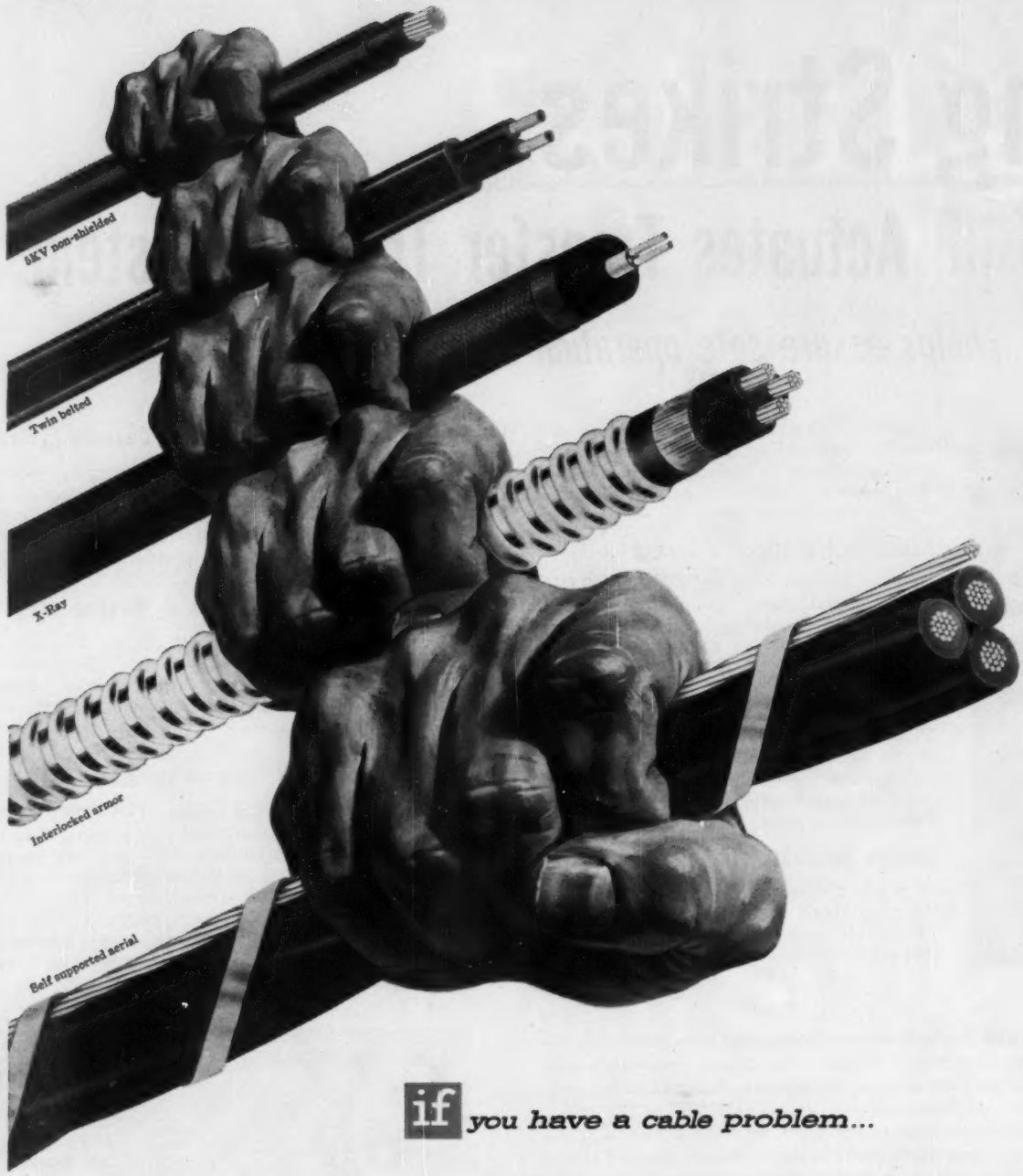
☐ Have RCA Microwave specialist contact me to explain RCA "turnkey" microwave agreement, and other services.

NAME_____ TITLE_____

COMPANY_____

ADDRESS_____

CITY_____ ZONE_____ STATE_____




## if you have a cable problem...

—and want Kerite insulation for a special application or unusual condition, you have only to lift the phone. Kerite specialists can show you cables for a wide variety of end uses and conditions.

Each combines Kerite insulation with outer coverings of the most advanced material and engineering. Each provides maximum service reliability and economy. And each has been *proved* on actual jobs.

As cable experts will confirm, no other cable can match this record of performance. We believe you will be impressed by the evidence.

Our headquarters is at 30 Church St., New York 7. Branches are in Ardmore, Pa., Boston, Cleveland, Chicago, Houston, San Francisco, Glendale, Cal.

**KERITE CABLE**

*it's the* **KERITE** *that makes the difference*

# Editorial Comment

MARCH 3, 1958

## Coordinated Effort Will Ease R/W Problems

As Electrical World's second Right-of-Way Meeting convenes in Chicago, this week, it is encouraging to find a growing recognition of the need for joint industry effort to ease right-of-way and site problems. We find support among planning engineers, system designers, right-of-way agents, and lawyers.

Many things might be accomplished by such a coordinated industry-wide effort:

1. Development of long range plans to be used by planning commissions in recognizing the requirements of electric utilities.
2. Preparation of model zoning laws that recognize utility needs.
3. Drafting of guides, exhibits and manuals to foster understanding and cooperation of planning commissions
4. Recognition of the need for large early investments.
5. Exchange of information on landscaping of substations and ways to make utility construction compatible with area planning.
6. Coordination of public information dealing with construction costs to avoid misleading situations.

Some individual utilities have already done considerable constructive work along these lines to meet local and regional needs. We believe the time has come to supplement these efforts at the national level.

## Where Does Reduced Insulation Belong?

Across our desk comes a letter, from a well-known engineering executive, voicing grave concern over the growing tendency today to extend the so-called "step-down insulation" technique into all sorts of related equipment when it properly applies only to internal insulation of fully-housed devices. He argues that once a satisfactory reduction is adopted, it is likely to be carried into air break switch insulators, bushings, pot heads and the like where it doesn't belong.

His arguments seem logical. They flag a tendency which, if allowed to go unrecognized, has the capacity to harm sound application of reduced insulation.

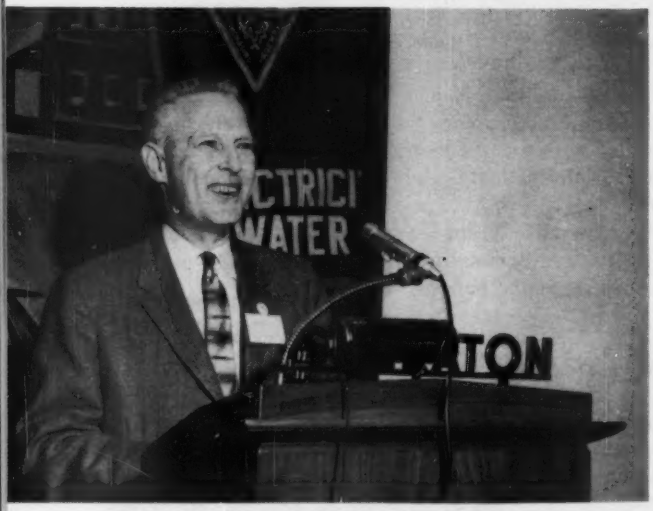
"To clarify thinking, let us divide the insulation in a substation into two parts, internal and external. The internal is the oil, cambric, paper and similar material inside the tanks of heavy equipment. The external insulation comprises the bushings, potheads, switch insulators, bus supports and the like.

"Internal insulation can be reduced proportionately to a reduction in lightning attack. It is better protection against lightning that has been the spark for 'step down insulation'. External insulation, however, has many additional problems. It must withstand lightning, of course, but it must also withstand switching surges and normal operating conditions. It must stand up under a witches' brew of dirt, moisture, fog, drizzle, sleet, hail, snow—all combined in a random completely—unpredictable manner in no way related to lightning and BIL.

"When an engineer lets acceptance of reduced BIL for his equipment affect the amount of external insulation he uses, he is treading on dangerous ground. The industry has been 50 years or more arriving at acceptable sizes and standards for satisfactory operation. Such standards cannot be achieved by test in a laboratory. Behavior under dirt conditions cannot even be approximated by test. Standards must be built up painfully, year after year, by trial and error in the field. To throw all this experience away seems foolhardy indeed."

GROUP CHAIRMAN HAROLD T. BELCHER, advocated more competitive bidding in opening remarks at conference

J. F. LINCOLN told how his company had succeeded in combating inflation through profit-sharing system



ROBERT B. GEAR: Buying for the immediate bargain is "like trying to squeeze more out of a grapefruit . . ."

J. D. HOGG pointed out that inflated prices are built into a utility's capital structure, effect lasts years

# Buyers Get Tips

Some down-to-earth tips for cutting costs through smart purchasing came from both purchasing agents and suppliers addressing the mid-winter conference of the Public Utility Buyers' Group in Philadelphia.

In his opening remarks, Group Chairman Harold T. Belcher, Consumers Power Co, stressed competitive bidding as one way of combating price rises.

Other speakers keyed their speeches to cutting costs through prudent purchasing practices.

To help keep wire and cable costs in line and improve delivery service, J. L. Tindale, Manager of Utility Sales, Anaconda Wire and Cable Co, offered these suggestions:

- Expand the use of non-returnable reels. This saves manufacturers the cost of paying return freight on empty reels and reduces the utility's accounting and storage expenses.
- Standardize on just a few sizes of non-returnable reels.
- Boil down from 15 to say 3 or 4, the number of different coil dimensions.
- When a new type of construction is settled on, let's throw out some of the older ones so we're not making the same cable 32 different ways.
- Appoint a committee from the Utility Buyers' Group to work toward standardization.

Purchasing Director Robert B. Gear, Commonwealth Edison Co, focused attention on reducing tax burdens in the purchasing operation. He noted that some states have sales or use taxes or both applying to the bulk of material bought. In some states, interstate transactions are not taxable. In others there is one charge for use and a higher rate for sales taxes. In some states, special made-to-order items are not subject to tax.

Purchasing agents, said Gear, should keep close tabs on invoices to make sure they are not paying taxes on exempt items. He further noted that in some areas freight, if paid by the purchaser, or if paid by vendor and contracted for separately, is not subject to the sales

C. F. OGDEN gave business review of 1957, said much can be gained by correctly forecasting time of upturn

J. L. TINDALE gave pointers on cutting cable costs. Main tip: Standardize on wire specs and packaging

# on Cost Cutting Techniques

or use tax that otherwise would apply.

Among other cost-saving tips offered by Gear were:

• Establish specifications without frills. Buying brand names may mean buying a lot of advertising and sales expense, but it also can be less expensive than special made-to-order items.

• Adopt the use of blanket, open, or master orders to eliminate the cost of processing many small requisitions into orders for those commodities and services that can economically be handled this way.

• Consolidate purchases for all locations to take full advantage of quantity or other discounts available.

"Every buyer owes it to himself and his company to obtain all reasonable worth in what he buys," continued Gear. "But if he goes beyond reason—if he imposes excessive and improper pressure—well, maybe he can drive a harder immediate bargain, but maybe it turns out to be no bargain for him at all in the long run. This kind of buying is like trying to squeeze more out of a grapefruit than there is in it. This may bring bitter results."

### Profit-Sharing Boosts Efficiency

J. F. Lincoln, Chairman of Board, Lincoln Electric Co, described how his company has succeeded in combating inflation through its well-known employee profit-sharing system. Lincoln suggested that industry might very well give serious consideration to such a plan, since it has been instrumental in boosting Lincoln Electric's efficiency so consistently that today its products are priced lower than in the late 1930's.

Inflated prices are of concern to utilities, said J. D. Hogg, Manager, purchasing department, Cleveland Electric Illuminating Co, since utility costs loom so much larger than most industry costs in the price for which they sell their product or service.

"Typically what the manufacturing industry buys today it sells in altered form tomorrow. With the exception of fuel, this is not true of electric utilities. Rather, what they buy is built into the capital structure and affects costs and individual prices for many years to come." As an example Hogg cited utility wire and cable purchases made when copper was selling for 46 cents per pound.

Hogg suggested that industry might do more research to improve the efficiency of production, distribution, selling and even buying.

Although the price of copper has been declining for a year and a half and steel and aluminum is facing over-production, "PA's must still keep in mind the inflationary effects of the Full Employment Act . . ." cautioned David Williams, manager, cable bureau, Consolidated Edison Co.

Here is how Williams summed up the outlook for each of these all-important metals.

• Steel—Declining demand, and falling scrap prices will tend to lower iron and steel prices. Cyclical studies, said Williams, indicate a peak in the 1st quarter of 1957 to be followed by a decline to the 3rd quarter of 1960.

• Copper—Cyclical researchers indicated a peak during the 1st quarter of 1956 to be followed by a decline to the 4th quarter of 1960.

• Aluminum—Over-capacity will result in a weakening price structure. However, the aluminum industry's ability to develop new markets, gives promise that any over-capacity will be of relatively short duration.

PA's have an opportunity to make substantial gains if they can correctly forecast the timing on the upturn in business, said C. F. Ogden, Vice President, Purchases and Real Estate, Detroit Edison Co. Signs of an upturn, Ogden suggested, should be indicated by inventories, government spending, consumer spending and even labor negotiation since they will reflect the business picture.

More than 740 buyers, vendors, and their wives turned out for the Philadelphia session.

# New Plan for REA Loans

- Offers co-ops four sources of financing
- Would de-emphasize 2% direct loans
- Chances slim of election-year action

The Eisenhower Administration is offering a compromise approach to its goal of substituting private financing to electric cooperatives in place of direct government loans, wherever possible.

Last week, Under Secretary of Agriculture True D. Morse submitted the draft of a four-pronged proposal which—while not ending outright Rural Electrification Administration's 2% direct loans—appears aimed at phasing them out. It's doubtful that congressional champions of REA will go for the program in this election year.

### Plan Proposes 4 Loan Types

The proposal would create a revolving fund—under trusteeship of the Secretary of Agriculture—from which future REA loans would be made. Congressional appropriations, co-op repayments on existing loans, and proceeds from proposed bond sales to private investors would go into the fund. Four types of loans would be available to co-ops:

- Direct REA loans at 2% would remain available under Title I of the Rural Electrification Act, just as now, to the extent that Congress appropriates money for such loans and leaves the interest rate fixed at 2%.

President Eisenhower's budget proposes appropriation of $175-million for such loans in the fiscal year beginning July 1. The National Rural Electric Cooperative Association, pointing to the $323 million appropriated for REA loans in the current fiscal year, claims the Administration plans to run out of direct loan money by early 1959.

- Secretary of Agriculture would be authorized to sell revenue bonds to banks or other financial houses, with the proceeds going into the revolving fund. Interest paid on these bonds would "compare favorably with rates paid by the Treasury on comparable maturities." Direct REA loans—long or short term—could then be made at interest rates reflecting the government's cost of money.

Co-op repayments would go back in the revolving fund, from which the U. S. in turn would retire its outstanding loans from private investors.

- Bonds could be sold by the fund administrator, under the proposal, up to 50% of the revolving fund's assets. Since REA had $3.8 billion outstanding in loans last Dec. 31, a maximum of close to $2 billion could be raised for the fund.

Co-op borrowers could obtain money directly from private sources, with loans insured by REA. Loans would be negotiated by the borrower, subject to REA approval of terms—including reasonableness of the interest rate. Borrowers would pay insurance charges of 1% annually of the unpaid balance to cover administrative expenses.

- An insurance fund would be established to supply the funds needed to back up the loan guarantees. An initial $1-million would be appropriated, under the proposal, with insured private loans in fiscal year 1959 not to exceed $150 million.

Where an existing REA borrower seeks additional funds, the Secretary of Agriculture can smooth the way for private financing by subordinating the government's lien to that of the private lender. Such action would be taken only where it is determined that both government and private loans are adequately secured. No insurance charge would be involved.

In a letter to REA members, Administrator David A. Hamil says, "What interest rate would be required by private lenders cannot be predicted. However, enabling borrowers to offer a first lien to private lenders should attract money at a lower cost than would be the case if there were no subordination of the government lien."

### Modifies Administration Aim

The proposed program obviously is aimed at blunting some of the congressional opposition to the Administration's dual proposal that: **1.** REA direct loans be made to carry an interest rate commensurate with what money costs the U. S. Treasury. **2.** Private lending be encouraged in place of government loans.

Legislation has been introduced by Sen. Homer Capehart (R-Ind.) and Rep. Edgar Hiestand (R-Calif.) to accomplish the first objective. But opposition is so strong even among Republicans that no hearings are considered likely. Any legislation flatly substituting private financing for government loans would have even less chance.

It remains to be seen how seriously the proposal, embodying something of a compromise, will be taken. At mid-week, legislation carrying out the plan had not been introduced and no hearings had been scheduled by the Senate or House Agriculture Committees.

### NRECA Voices Opposition

NRECA already has offered sharp opposition.

Clyde Ellis, NRECA general manager, told the association's meeting in Dallas recently that the Administration had drafted a proposal aimed at turning "us away from REA and into the open money market." (EW Feb. 24 p 68)

He charged that the plan would give the Secretary of Agriculture full control over the REA loan program. And he said co-ops would be unable to obtain sufficient private financing.

# How U. S. A-Policy Is Shaping Up

**Democrats have manufacturers' support on stepped-up U. S. program; Dr Starr's low-cost proposal sparks interest**

Powerful congressional Democrats are showing intense interest in a proposal to accelerate the development of nuclear power—and blunt some of the controversy over how to do it—by directly subsidizing construction and operation of U. S.-built reactors abroad.

The Democratic majority of the Joint Committee on Atomic Energy says Atomic Energy Commission's "partnership" policy with private industry has proved inadequate.

These critics readily concede that, in view of this country's ample supplies of low-cost fossil fuels, there is no pressing demand for development of nuclear power in this country. But they warn we cannot afford to let domestic economics set the pace in this field—that we must forge ahead in order to maintain U. S. prestige abroad.

AEC Chairman Lewis L. Strauss denies Democratic charges of "complacency." However, he has agreed to behind-the-scenes negotiations with the committee to hammer out a common approach to the problem.

Results of the negotiations, if any, probably won't be clear until around mid-March when AEC officials are expected to testify before JCAE on the power reactor program. JCAE is conducting its annual hearings into the atomic industry's progress.

### Reactor Makers Agree

However, the Democrats already have plenty of support from spokesmen for reactor manufacturing and equipment firms.

Almost to a man, witnesses for these firms agreed last week that:

- The reactor development program is lagging badly, and only a more vigorous federal program can save the industry from losing out in the technological contest with Britain and Russia.
- Since nuclear power cannot hope to compete meaningfully with conventional power in the U. S for ten years or more, emphasis should go to development of a foreign market for our atomic industry.
- Biggest deficiency in the U. S. program, especially in the eyes of foreigners, is its uncertainty. Long-range objectives must be established and programs to accomplish these aims agreed upon.
- Foreign nations hesitate to become committed to U. S. reactor technology and nuclear fuel supplies unless they are guaranteed long-term supplies at reasonable prices. Guarantees are not available now.

Michael Michaelis, speaking for Arthur D. Little, Inc, proposes the domestic reactor program be accelerated by lowering government prices for nuclear fuel.

### Dr Starr's Plan Sparks Interest

However, JCAE listened with the most interest to a proposal by Dr Chauncey Starr, vice president of North American Aviation's Atomics International Div. He suggested that the task of outshining the Soviets in peaceful uses of atomic energy can be linked to the long-range goal of developing competitive nuclear power in this country.

Specifically, he proposed that:

- Foreign participants be allowed to purchase atomic power plants from U. S. firms during the next ten years at about the same price they would pay for a conventional plant of the same output. The U. S. government would pay the U. S. manufacturer the differential between his price to the purchaser and the actual cost. The U. S. manufacturer could subcontract semi-conventional parts of reactor construction, and sub-license manufacture of some reactor components, to meet national interests of foreign participants.
- The U. S. would provide the fuel elements for operation of these plants on a long-term basis—up to 20 years. We would maintain ownership of such fuel, and sell to the user only the heat produced, at the same price as heat produced from conventional fuels overseas.

The U. S. would obtain fabricated fuel from U. S. manufacturers, provide it to overseas customers, then take the irradiated fuel back for reprocessing. This would be on a long-term basis.

Starr estimates total cost of the program over a ten-year period at only $160-million—$130-million for plant construction subsidy, the rest for the fuel subsidy.

"Our government would be paying only the differential between conventional and atomic power, not the total cost," he emphasizes. Starr claims the subsidy would grow less each year as U. S. manufacturers become more efficient, until even the fuel subsidy should end within 20 years. And the U. S. would be prepared for competitive nuclear power at the proper time.

His figures assume the U. S. would subsidize construction abroad in the 10-year period of five reactors rated at 60,000 kw, and five at 200,000 kw. AEC would determine what types of reactors would be built under the program, he said.

In political terms, Congressional sources see both merits and demerits in the plan.

### Could Ease Federal-Private Issue

On the plus side, it would go far in sidestepping the private-vs-federal power issue by reducing demands for construction of large-scale nuclear plants in the U. S. It presumably would be supported by most reactor manufacturers. It would be less expensive than a federal program.

On the other hand, the plan would invite charges of being another "giveaway" program to help foreign industry compete with U. S. firms. Also, it would force the U. S. to run the grave risk of a radiation accident that Soviet propagandists could use to blacken the U. S. reputation abroad—thus defeating one of the program's main purposes.

# Economy Pick-Up Is Due

**This is view, at least, of relatively optimistic forecasters and Administration. But regional picture remains mixed**

The decline we're in now should level out over the next few months, then pick up in the second half.

This is the view of McGraw-Hill's Economics Department. It's a view that parallels—but perhaps with not as much optimism—President Eisenhower's recent statement of "early resumption of sound growth . . ."

The economy is approaching a low point, McGraw-Hill economists believe. Basis for the coming upturn is pegged to an inventory turnabout and an increase in new defense orders. However, the economy will not regain boom conditions until capital expenditures reverse their downward trend.

Consumer spending plans will be influenced by an expected gradual rise in personal income through the year, the economists predict.

Meanwhile, from two regions come reports on both the dark and bright side: Items:

### Northwest: Hopes for Housing

No significant improvement in economic activity will occur in the Pacific Northwest before spring, informed observers agree.

Only trouble with this is the difficulty of telling when winter ends and spring begins. This perennial Pacific Slope problem is heightened by a mild winter. Dealers find little demand for snow tires or anti-freeze, top-coat prices have been cut, fewer kwhrs are needed for lighting.

The expected upturn in residential building is one main reason for optimistic views of spring recovery. A basic industry in the Pacific Northwest, lumber currently is hurting from a low price level, although prices last month showed signs of steadying.

Unemployment will remain higher than last year's levels until fall, but a decline in unemployment has begun.

Boeing Airplane Co of Seattle, biggest employer in the area, will hire a few hundred additional engineers in a research build-up. Boeing is rehiring some production people laid off last year, but the 1958 employment outlook is one of slow decline.

Office building and road construction are bright spots of the area. Impact of reduced mining operations, though, has been felt in Washington and northern Idaho.

### Ohio: Glimmer of Good News

In the last decade, a concentration of automotive parts plants in northern Ohio has made transportation equipment the area's top industrial employer, followed by metal fabricating and basic steel making. Their progress shapes much of the region's economic character. What's happening now is this:

- Softened demand for new cars has brought a corresponding curtailment in Ford, General Motors, and Chrysler plant production around Cleveland.
- New metalworking orders have pointed lower since mid-1957. The curve has levelled, but there are few indications of early improvement.
- Steel production in the Cleveland-Lorain district slid to 34.5% of rated capacity earlier this month.

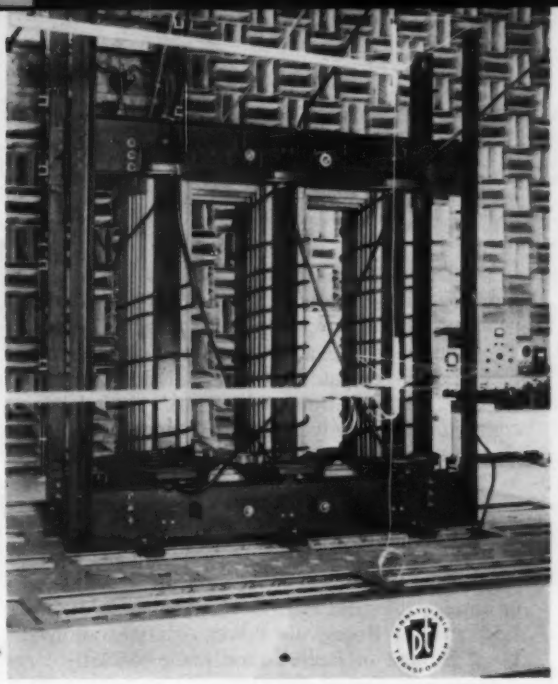
Heavy concentration in durable goods is a big factor in 90% rise in unemployment in Cuyahoga and Lake counties where idle workers now total about 60,000. Ohio unemployment has passed the 200,000 mark.

First glimmer of good news for hard-hit Youngstown came last fortnight when Republic Steel began recalling workers. Some observers see this as evidence that inventory corrections, which played a big part in steel slowdown, have run their course.

## Scattergood Buried in Sand, Water Flood

More than 20 ft of water and sand covered two cranes, a pair of bulldozers, and a $1-million condenser at the site of Los Angeles Department of Water & Power's Scattergood Steam Plant Feb. 19. The flood followed breakage of a 5-ft storm drain during a heavy rainfall. One early, unofficial estimate placed damage cost at more than $1 million.

**DEDICATION of Thomas A. Edison Acoustical Research Laboratory finds (left to right) C. C. Honey, electrical research engineer, closing switch to lab test circuit; W. E. Kerr, president, ready to press button that will energize line to transformer core; and A. L. Horelick, engineering manager**



**NOISE TEST on transformer core shows demonstration windings and microphones in Pennsylvania Transformers's lab**

# Million Dollars Worth of Silence

The million-dollar Thomas A. Edison Acoustical Research Laboratory at Pennsylvania Transformer Division, McGraw-Edison Co, Canonsburg, Pa., opened Feb. 11. The dedication ceremonies marked both the 111th anniversary of the birth of Thomas A. Edison and the beginning of National Electrical Week.

Principal purpose of the laboratory is to provide complete facilities for testing and analyzing—and thereby reducing—transformer noise. In certain voltage classes, transformers even larger than 100,000 kva can be tested. The equipment will permit complete "plotting" of vibrations to pinpoint sources of noise. This will permit corrective measures in current production and also point the way to more effective design.

The laboratory is located on seven acres next to the Canonsburg plant. Main room is a 40x45x35-ft high anechoic chamber which provides a degree of quietness that few people ever experience. Its ambient sound level is about 16 db, or below the scale range of the "40 db weighting network" employed as a noise-level meter by the industry.

To get this degree of silence, the laboratory is located in an area beyond the range of disturbing traffic noises. Outside walls are constructed of 8-in. concrete block to keep sounds from the room. To keep the hum of transformers under test from being reflected off walls, the anechoic chamber interior is lined with wedge-shaped pieces of light-density glass fiber. The wedges are more than 3-ft thick, and a boxed 4-in. air space separates wedges from the walls.

The anechoic chamber is equipped with the most modern sound detection and analyzing equipment available. There are condenser microphones with calibrating equipment, an electronic wave analyzer and several other analyzers, vibration pickups, and associated apparatus. The power supply room is separated from the anechoic chamber by an acoustical door. This keeps noise from the necessary step-up transformers (connected to West Penn Power Co's system) from affecting noise level measurements in the anechoic chamber. These transformers and their associated regulators furnish the required "excitation."

Additional power, for research purposes, is provided by a variable-frequency, motor-generator set located in another building, where the noise of the generator will not disturb quietness of the laboratory.

Transformers being tested are brought into the laboratory on a specially constructed transfer car that has no springs. Made of steel and concrete, the transfer car is designed so that it will not be subject to sympathetic vibrations.

Augmenting efforts of specially trained company personnel in charge of the laboratory are consultants at the University of Pittsburgh.

Dedication speakers included the following Pennsylvania Transformer officials: W. E. Kerr, president; W. R. Swoish, vice president; Arnold Horelick, engineering manager; H. D. Salton, chief design engineer; and Charles Honey, electrical research engineer in charge of the laboratory. Also participating was K. C. Stewart, professor of acoustics in the University of Pittsburgh's Graduate School of Public Health. Stewart is a company consultant on acoustical research.

Arnold Horelick, engineering manager, pointed out that with this laboratory, Pennsylvania Transformer can accelerate a noise-reduction program that already has resulted in considerable improvement in this field. The company expects to make further progress in core, coil and tank relation. An aim is to get optimum low level with economic use of materials.

# The News-Beat

## Matter of Security

National Electrical Manufacturers Association representatives appeared before the Ways & Means hearings on reciprocal trade extension last week. Their purpose: protection against import of foreign made power generators and transmission equipment.

A. F. Metz, chairman of NEMA's capital import committee, said early action by Congress is required to prevent continued importation of such equipment in the interest of national security. In 1956, foreign manufacturers captured half the average annual American market for hydraulic turbines, and government purchases contributed substantially to it, he said. Corps of Engineers bought 26% of all types of power equipment from foreign sources in 1956, he said, and the Bonneville Power Administration and U. S. Bureau of Reclamation made similarly large purchases.

W. J. Rheingans, chairman of NEMA's hydraulic turbine section, said importation of hydraulic turbines threatens continued existence of American manufacturers of hydraulic turbines and constitutes impairment of national security and defense.

## Penn P&L Plans A-Plant

A commercial-size homogenous-type power reactor will be built by Pennsylvania Power & Light Co and Westinghouse Electric Corp. Atomic Energy Commission will provide research and development assistance as a part of its "partnership" program of reactor development.

The plant would cost about $108 million if carried through and will generate from 70 to 150 Mw (electric).

AEC Commissioner John Graham, a Democrat, objected to agency approval of the project on grounds the homogeneous-type reactor should be studied further. In Congress, Rep James Van Zandt (R-Pa.) hailed the "pioneering spirit" displayed by the companies.

Adm Lewis E. Strauss, AEC chairman, can cite the planned reactor as indication that reactor development under his "partnership" program is moving ahead despite Democratic and industry criticism. However, key House members of the Joint Committee on Atomic Energy are swinging behind a plan to step up development by subsidizing U. S. manufacturers selling reactors abroad (see p 67).

## 'In Lieu' Tax Drive

A series of meetings last month found Omaha Public Power District and Consumers Public Power District employees being urged to enlist the help of neighbors and friends in the signing of petitions which would set in motion a proposed Nebraska constitutional amendment. The two agencies are backing the drive to assure constitutionality of making payments in lieu of taxes for real estate or public utility property. The amendment would have the systems pay 1957 amounts or a maximum of 5% of gross retail revenues, whichever is greater.

If the petitions gain enough signatures and the measure is passed Nov. 4, Rural Electrification Administration co-ops selling energy in Nebraska towns would be required to make payments in lieu of taxes; rural-area co-ops and municipal systems would not. OPPD General Manager Frank J. Moylan said his system would probably be able to hold the line on rates in spite of the further increase in costs expected by the tax payments.

## Yuletide Postscript

A $7.50 string of Christmas tree lights disappeared this year from a front-yard tree of Carl L. Whitman in Louisville. The lights were returned to Whitman's porch recently with a note:

"Dear Friends:

"We are so indeed grateful of the fact that you were kind enough to let us borrow your tree lights this Christmas. Our tree sure sparkled. Sorry we are so late in returning your lights; but just be thankful that you got them back! (Signed) Grateful.

"P.S.: See you again next year!"

## Under Cover Work

Cleveland Electric Illuminating Co has moved 14 floors of desks, typewriters, and files into the new Illuminating Building next door, but the move was made under cover. The office furniture passed over two enclosed pedestrian bridges on the third floor. Only one truck was used: It hauled 800 rubber-tired dollies to the scene of action.

## Strike and Satisfaction

Production is continuing at Ohio Valley Electric Corp's Kyger Creek Plant despite a strike that began there Feb. 24. Supervisory personnel are maintaining operations at the 870-Mw station. Negotiating stumbling blocks that brought on the walkout includes the length of the contract and items to be incorporated in a reopening clause.

Carolina Power & Light Co employees have voted 505 to 130 against representation by Utility Workers Union of America. "The results speak for the good relationship existing between workers and supervisors," said H. B. Robinson, vice president and general manager.

# AIEE WINTER GENERAL MEETING

A record attendance of 5,340 engineers and their guests attested to the excellence of the technical program of the week-long 1958 winter meeting of the American Institute of Electrical Engineers at New York last month.

The wide variety of technical fare offered to utility engineers was highlighted by a symposium on the safety aspects of a higher utilization voltage. In other sessions, discussions dealt with the 30-mile St. Lawrence submarine cable, the high flashover rates of transmission lines, high-speed reclosing on 345-kv lines, and a new method for determining reserve generating capability.

In this 12-page report, Electrical World offers you the highlights of a record 400 papers presented at 100 AIEE technical sessions and symposiums. This coverage is divided into seven general areas: distribution, cable, transmission, substations, relays, generation, and industrial. (The AIEE general session was reported in Electrical World, Feb. 17, page 62.)

## Distribution: Is Higher Voltage Safe?

- **Experts agree that, with precautions, higher utilization voltages will not compromise present safety**
- **Also discussed: standardized protection of 13.2-kv feeders; subtransmission planning; 46-kv oil reclosers**

Electrical distribution at 480Y/277 v will not compromise safety in a commercial building where it has been installed to obtain the outstanding savings it affords, said R. H. Kaufman, General Electric Co. Addressing an AIEE symposium on safety consideration in higher utilization voltages, Kaufman pointed out that distribution system components are available today permitting the use of this higher voltage in commercial buildings as well as in industrial plants.

But certain precautions, he said, are necessary. Only fixed machines and general area lighting should be served directly from the 480Y/277-v system. Other loads, particularly portable appliances and business machines, should be served at 120-v as in the past, this voltage being derived from 480-v circuits through small transformers.

All 480-v power circuit components, as developed for industrial plants, Kaufman said, can be applied directly in 480Y/277-v commercial building systems. High quality components and their correct application, he noted, are more important in the higher-voltage systems. For there, he said, deficiencies in system design or product quality can threaten more vicious effects than either would on 208Y/120-v systems.

The increase in 480-v power sys-

tems in industrial plants since the early '30's, he said, has led to the development of specialized products, such as load center unit substations, metal-clad low-voltage switchgear with a variety of short-circuit ratings, metal-enclosed unit and grouped combination motor controllers. Metal-enclosed high-quality components with adequate short-circuit ability, he noted, provide a high degree of safety.

### 265/460 Advantageous

The nominal 265/460-v system, supplying large industrial and commercial buildings, has been to the advantage of both the consumer and utility, said T. C. Duncan, Consolidated Edison Co. Although high-current installations, with attendant high short-circuit currents, are commonplace at 120/208 v, he said, the combination of high currents and 265/460 v merits and gets special consideration.

What is becoming the standard Con Edison installation, he said, is a 6-bank network of 2,000 kva, 7%-impedance transformers. This installation has a capacity of about 10,000 kva. The corresponding short-circuit current on a bolted fault basis is of the order of 200,000 amp at the bus. The customer is usually supplied by four bus-stab takeoffs from the network bus, each rated at 3,500 amp.

As persistent or re-strike faults are much more likely at 265 v than at 120 v, special precautions are taken. The bus, Duncan pointed out, is insulated to minimize establishment of an arc, and supports are of inorganic material to minimize the possibility of faults and to reduce fire hazard. The bus is in a dry place and protected by current-limiting fuses of the silver-sand type. Network protectors, connected to the bus through such fuses, assure rapid clearing of a defective supply source. Service takeoffs are equipped to isolate a fault on customer's equipment. Large limiters, sand filled to cool the gases and quench the arc, are used on cable connections at the higher voltage.

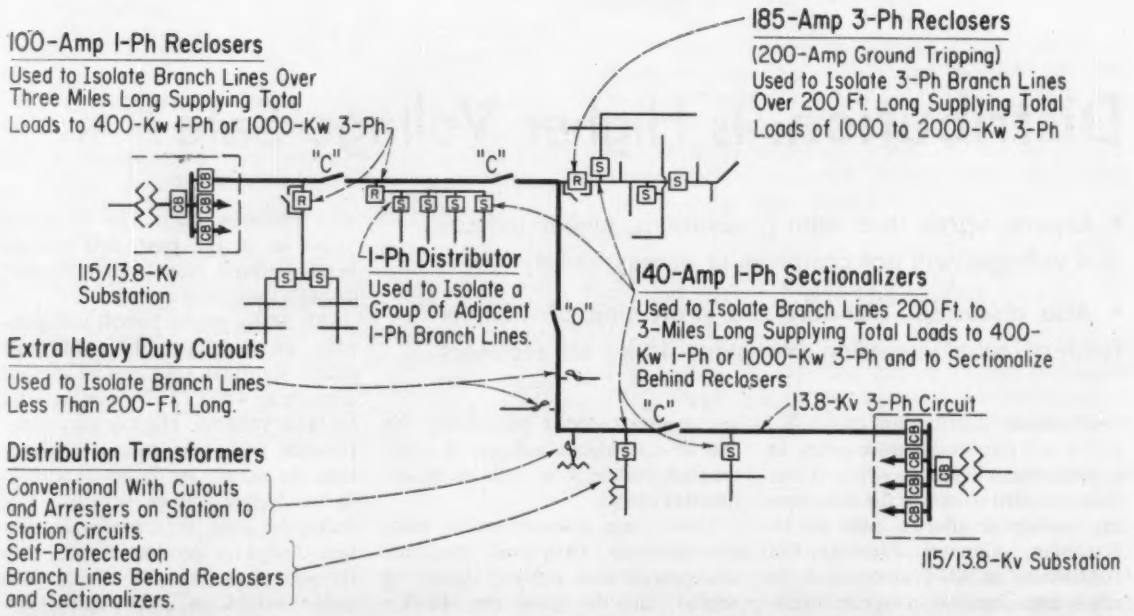
### 240/480 Favored for Homes

The 240/480-v, single-phase, 3-wire distribution system has been found to be the most economical for residential service, said A. S. Anderson, Ebasco Services, Inc. But until appliances for 240-v-to-ground operation are available, he said, this system must be modified to provide 120-v service through autotransformers. And savings with autotransformers over the present system, he added, are obtained only for customers with individual demands of 11 kva or more.

Rapid or wholesale conversion of present systems to a higher voltage is undesirable and impracticable, Anderson declared. But it could be assumed that new construction at the higher voltage could start with large new home developments with large loads. At first only major appliances would be served at the higher voltage, but economic pressure would inevitably grow for elimination of autotransformers. Code revision would then permit serving portable appliances at 240 v to ground. There is small chance, he said, that the difference in voltage per se would create the difference between safe and unsafe service.

### Proper Design Assures Safety

If wiring, accessories, appliances, and utilization equipment are designed for it, a higher utilization voltage with provisions for grounding and other safety features can be as safe as present domestic voltage levels in Canada, said H. Hyde, Toronto Hydro-Electric System. Accordingly the question resolves itself purely into one of economics. Were the changeover carried out


100-Amp 1-Ph Reclosers
Used to Isolate Branch Lines Over Three Miles Long Supplying Total Loads to 400-Kw 1-Ph or 1000-Kw 3-Ph
185-Amp 3-Ph Reclosers
(200-Amp Ground Tripping)
Used to Isolate 3-Ph Branch Lines Over 200 Ft. Long Supplying Total Loads of 1000 to 2000-Kw 3-Ph
"C"
"C"
115/13.8-Kv Substation
1-Ph Distributor
Used to Isolate a Group of Adjacent 1-Ph Branch Lines.
"O"
140-Amp 1-Ph Sectionalizers
Used to Isolate Branch Lines 200 Ft. to 3-Miles Long Supplying Total Loads to 400-Kw 1-Ph or 1000-Kw 3-Ph and to Sectionalize Behind Reclosers
Extra Heavy Duty Cutouts
Used to Isolate Branch Lines Less Than 200-Ft. Long.
"C"
13.8-Kv 3-Ph Circuit
Distribution Transformers
Conventional With Cutouts and Arresters on Station to Station Circuits.
Self-Protected on Branch Lines Behind Reclosers and Sectionalizers.
115/13.8-Kv Substation

**STANDARDIZED SCHEME for protecting 13.2-kv feeders eliminates analysis of each feeder and sectionalizing point. Only load, length, and exposure of branch line are needed to select from a table the proper device for that branch**

now, he said, the possible savings at the distribution levels would be small compared to the cost at the consumer's end. Yet this latter cost would be relatively low, he added, if preparations were made now for changeover in, say, 15 years.

### Requires Better Inspection

In Europe, where 220/380-v, 50-cps service is fairly general, the consensus is that autotransformers for lighting and small appliances are a nuisance and would not work, said L. D. Price, National Electrical Manufacturers Association. Introduction of similar residential distribution voltages here, he said, would entail more rigid control of approval of materials and equipment for use by the public; more rigid installation inspection and periodic re-inspection; greater need for uniformity of regulation throughout the country; and a tremendous safety educational program for the public.

Were such provisions made, there would be no increase in hazard, he said, but as such provisions are practically impossible here, a change of present practice should not be recommended.

Use of circuits having more than 150 v to ground conflicts with limits now prescribed for dwellings by the National Electrical Code, said D. B. Anderson, Underwriters' Laboratories, Inc. As voltages to ground over 150 v would be confined to fixed appliances, shock hazard could be reduced to an acceptable level in devices suitably modified.

### 2-Winding Transformer Preferred

Autotransformers for branch circuits are permitted by the NEC, he said, only where the supply system is grounded solidly to the system. As the proposed 2-wire, 240-v-to-ground supply would impose 240 v on the secondary when there is an opening in the transformer winding, there would be serious fire hazard. An insulated secondary transformer, he said, appears warranted.

A 2-wire, 240-v circuit would call for major redesign of ranges and clothes dryers, and a 240/480-v, 3-wire, 240-v-ground system would require changes in overcurrent protective and control devices. The main circuit, he said, would need fuses rated at 600 v, or circuit breakers rated at 480 or 600 v, and branch circuits 250-v cartridge fuses or 240-v circuit breakers.

**RECLOSERS ON 46-KV SUBTRANSMISSION of Consumers Power Co are expected to provide valuable service improvement over fuses on loops and radial lines**

Designing and building motors smaller than approximately ⅓ hp for voltages greater than 120 v involves five important factors, said C. G. Veinott, Reliance Electrical & Engineering Co. These factors are: increased spacings for live terminals; increased and improved solid insulating materials; coils of many more turns of finer and more fragile wire (attended by a poorer space factor); increased number of commutator bars for commutator motors; and greater size, weight and cost for accommodating these factors.

### Motors Over 1/3 Hp Go 240-V

But generally, he said, motors above ⅓ hp are or can be made operative on voltages in the 240-v range. For motors larger than about 1 hp, design and manufacturing advantages adhere to the use of 240, he said, adding that 440 v presents problems for capacitor-start motors. Fire and shock hazards, however, increase at 240 v when exposure is occasioned by premature equipment failure, degradation of insulation through use or aging, or failure due to other causes, unintended operation or accidental nullification of built-in protection by mechanical breakage.

Most room air-conditioners and all larger central systems for residential and small commercial use operate at about 240 v, 120-v to ground, said G. S. Price, Air-Conditioning & Refrigeration Institute. "Our chief interest," he said, "must be to continue to avoid increasing the number of different voltages so that we can produce products at minimum costs for installation anywhere in this country."

### Standardize 13.2-Kv Protection

A simple, standardized scheme for protecting feeders highlighted the session on distribution.

In a new plan for installing automatic line sectionalizing devices on 13.2-kv feeders, Public Service Co of Colorado has eliminated the need for individual analysis of each feeder and sectionalizing point. The plan standardizes feeder protection so that only the load, length, and exposure of a branch line must be known to select from a table the proper device for that branch.

Basic idea is to provide devices to isolate automatically each faulted lateral or distribution transformer from the main circuits of 7.6/13.2-kv grounded wye feeders. J. R. Hayden, J. E. Martin, and R. L. Tillson said the plan has produced definite operating benefits and savings in engineering time, record keeping, and storekeeping. It calls for no automatic devices in the

main circuit of the feeder. However, the main is protected from each branch by standardized application of only four devices in terms of branch circuit load, length, and type of exposure. These protective devices are:

### Plan Uses 4 Devices

- Single-phase sectionalizer rated 15 kv, 140 amp continuous, 220 amp counting, and withstand of 4,000 amp symmetrical, set for two counts to lockout.
- Single-phase recloser rated 15 kv, 100 amp continuous, 200 amp minimum tripping, and 4,000 amp symmetrical maximum interrupting, set for two fast and two retarded operations.
- Three-phase recloser equipped with ground tripping, rated 15 kv, 185 amp continuous, 370 amp minimum tripping, 200 amp minimum ground tripping, and 4,000 amp symmetrical maximum interrupting, set for two fast and two retarded operations.
- Extra-heavy-duty open cutout rated 15 kv, maximum interrupting rating 10,000 amp symmetrical. Branch line cutouts are fused with 100K links; transformer cutouts are fused according to transformer ratings.

### Plan Subtransmission Savings

A study of the economics of subtransmission planning, reported by D. N. Reps, Westinghouse Electric, showed:

**1.** Subtransmission plus distribution-substation step-down transformer investment can vary over a 20-to-1 range—$15 to $300 per kva—depending partly on system load and density, partly on system voltages.

**2.** For any given set of system voltages, the economic size of subtransmission substations increases with load density. As load density increases from 30 to 125, and then to 500 and 2,000 kva per sq mile, all cost curve minima shift generally toward higher Mva load served.

**3.** At any load density, a higher primary-feeder voltage should be supplied from larger subtransmission substations. As primary-feeder voltage increases, the minimum-cost points on the cost curves shift higher.

**4.** As load and density increase, systems with a higher ratio of subtransmission to primary-feeder voltage are less likely to require extraordinary reinforcement expenditures to serve new loads.

**5.** The much greater cost variation of different voltages at the lower densities indicates the need for a thorough economic review of rural-area distribution systems. The costs per unit load served are inherently high in rural sections, and, consequently, cost savings may be greater through the proper choice of system voltages.

The above conclusions were based on a study of the comparative feasibility of several subtransmission and primary-feeder voltages under conditions of increasing load and density. Densities of 31, 125, 500, 2,000 and 8,000 kva per sq mile were selected to carry the systems through the complete range from rural to heavily loaded urban areas.

### Reclosers Used at 46 Kv

The sharp rise in distribution voltage has prompted development of an automatic oil recloser for use up to 46 kv. Deriving directly from existing designs of power reclosers for lower-voltage application, the new device is series-connected and electro-magnetically operated, controlled by "components similar, and in some cases identical, to corresponding components" of earlier designs. Like its predecessors, it is a single-pole device but designed with a view to subsequent gang operation, said E. J. Field, I-T-E Circuit Breaker Co.

Extensive tests prove the new recloser's ability to interrupt 250 Mva faults repeatedly in 2 cycles. Its combination of relays, control, and short-circuit protection in a self-contained single-phase unit provides utilities with an economical tool for subtransmission switching.

C. R. French said that the first units were placed in service without difficulty on Consumers Power Co's extensive 46-kv system. Working procedures were identical with those for lower-voltage units. Expectation is that reclosers will provide valuable service improvement over fuses on 46-kv loops and radial lines. Extensive use of reclosers in lieu of circuit breakers at small substations was predicted by L. B. Crann, REA.

# Cable: How

- **Two economical methods recommended for getting full capability of buried cable**
- **Also discussed: aluminum aerial cable; St. Lawrence 30-mi 69-kv submarine cable**

Backfilling a trench with soil of low thermal resistivity has proved an economical method of utilizing the capability of buried cable, reported L. H. Fink and J. J. Smerke II, Philadelphia Electric Co. They plotted the isothermals and equipotentials of heat dissipation from a buried pipe and studied heat flow with a network analyzer and digital computer to establish the optimum cross section of selected backfill. The authors proposed a rectangular trench as a reasonable approximation and showed that soil beneath the pipe should be replaced to a depth almost equal to half the trench width for optimum benefits.

In discussion, C. R. North revealed that Philadelphia Electric has applied this method to boost 138-kv pipe cable ratings to 215 Mva for 2,000-MCM conductors with lower temperatures than previously allowed for 200 Mva. Cable connections for Eddystone Station total 67,000 ft at a cost of $5 million. Trenches will be backfilled with selected No. 2 sand to attain an 80-thermal-ohm earth resistivity.

Water cooling offers another means of overcoming the limitation of cable ampacity in soil of poor thermal characteristics, said O. Nigol and G. H. West, Ontario Hydro. Up to 45% more current can be carried on double-circuit runs by circulating water in external buried pipes, and 96% more with water-cooled pipe cable construction. Because water removes most of the heat, they said, earth resistivity, depth of burial, and mutual heating become almost negligible.

First use of water cooling on the Ontario system was planned to overcome 20% derating for a 350-ft hot spot caused by high earth

# to Boost Current Ratings in Poor Soil

embankments over four 115-kv cable circuits of a 3.5-mile run in Toronto. The method proved so effective in analyses that it has been installed along the entire run. Two ¾-in. polyethylene pipes will be buried in the sand between the conductors of each phase circuit. Cool water will be admitted every 4,800 ft from city mains and discharged to sewers at intermediate points. This system, to be installed for less than $100,000 and using about $5,000 worth of water per year, is expected to boost ampacities by 50% and eliminate need for two future cable circuits, they said.

Pipe-type cable was adopted as the economical way to connect the new Lombard Substation into Philadelphia Electric's 69-kv system, said R. H. Bolling Jr. Contributing factors were greater ease of installing a single pipe instead of concreted ducts in congested streets and ability to handle its oil from an installation at the substation. But ability to use pipe cable depended upon developing suitable joints between it and an existing oil-filled cable which was to loop through Lombard Substation. This was accomplished by trifurcating the pipe cable in special manholes along the existing cable, then flaring the separate conductors in 3½-in. copper tubes to special stop joints where they joined the oil-filled cable (EW, Nov. 11, 1957, p 61).

### Aerial Cable All Aluminum

Aluminum cable offers economies in aerial installations where its light weight permits longer spans and the strength and rigidity of the sheath resists fatigue and withstands higher internal pressures. J. F. Gillespie, Philadelphia Electric, said all these advantages proved helpful recently in running 33-kv subtransmission through city streets to a new distribution substation. Ability to use longer spans permitted the cable to be placed on existing poles. The stress-resistant aluminum sheath eliminated stop joints for the 120-ft difference in elevation on the 3,000-ft run.

The cable selected for this job has a single 500-MCM compact-stranded conductor, standard 35-kv paper insulation, 0.075-in aluminum sheath, and a 0.085-in. polyethylene jacket. Three such cables are twisted into a triplex and suspended in rings from a $\frac{7}{16}$-in. EHS steel messenger except where buried in sand at the substation.

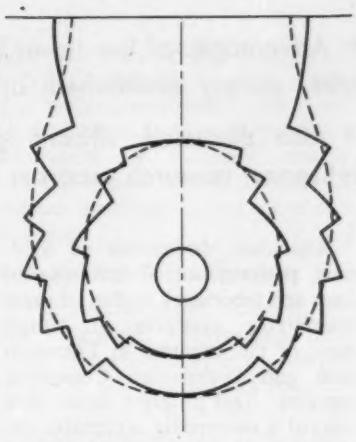
### St. Lawrence Takes 30-Mi Cable

Of the 30-mile 69-kv submarine cable crossing 1,200 ft under the St Lawrence River, H. D. Short, Canada Wire & Cable Co, said that never before has such heavy cable in such long lengths been installed in such deep water. With co-authors D. M. Farnham and S. H. Cunha of Quebec Hydro and G. B. Shanklin, Short presented detailed description of the cable manufacture and experimental program associated with this pioneer project. It was the second in a series of papers on the project. The first, dealing with basic design and data, was presented for discussion.

The St Lawrence cable was installed in 12 lengths: 4 main lengths 24-miles long and 8 shore ends some 3-miles long jointed by 8 marine splices. Elliptical solid-type 69 kv cable with 450 mils of insulation (rather than 650 mils) was selected because, when suitably impregnated with viscous rosin-bearing compound, it was found to respond well to external water pressures ranging from 40 to 540 psi. The elliptical cross section gives the greatest response to external water pressure and maintains an internal cable pressure approaching external pressure.

The lead sheath was topped with a rubber sandwich seal and two compounded jute servings to separate it from the 26 aluminum armor wires which in turn were covered with two compounded jute servings. Weight of the 500-MCM cable is 9.87 lb per ft in air; 6.92 lb per ft in water. It has a ratio of weight per nautical mile to breaking strength of armor of 21:37 tons.

Main cable was made up to the sheath in 3,900 to 7,400-ft lengths at the factory and shipped in drum lengths to the armoring plant where the 93 shipping lengths were jointed and continuously armored to produce finished lengths. These joints were required to have the same diameter over insulation as the cable. Objective was a joint equal to 80% of cable's characteristics. This was justified on the ground that joints would be under a minimum external pressure some 40 psi greater than the pressure of the cable itself.



**PIPE CABLE cross section shows zones for backfill selected for thermal quality to gain best cable economy**

During discussion R. M. Fairfield, British Insulated Calendar Cable, questioned suitability of solid-type cable and separate armoring of the cable in drum lengths on grounds that electrical factors of safety were not well enough known. He saw little point in testing factory lengths of cable when handmade joints were obviously the weakest point.

### Crossing to Be Double Circuit

In closure, Farnham disclosed plans to add two more cables to the four now in place and operate two circuits; space has been provided for a seventh cable. Maximum loading of the cable at 69-71 kv is less than 300 amp. Temperature of the armor is isolthermal at 3.8C. Conductor operates at 34C with a temperature drop of about 31 across the insulation. Shanklin felt Fairfield's concern regarding compression cable was unfounded. Extreme viscosity of compact cable in a refrigerated condition would allow tides and water pressure to effect insulation seriously.

# Transmission: Abnormally High

- **Advantages of low tower height and double ground wires clearly established, but not fully explained**
- **Also discussed: silicone grease; sources of radio influence; research program on high-voltage cable**

Analytical discussions of lightning performance of transmission lines and laboratory studies of radio interference continue to absorb most of the attention in Transmission and Distribution Committee sessions. Real progress seems slow toward a universally acceptable explanation of abnormally high flashover rates on certain 138 and 345-kv lines. But the advantages of low tower height and double ground wires are clearly established . . . if not yet adequately explained.

Studies of lightning performance of 138-kv lines with one and two ground wires, reported by R. W. Caswell and E. F. Koncel, Commonwealth Edison, with E. T. B. Gross, Illinois Institute of Technology, led them to conclude that good performance with double ground wires is traceable to: (1) reduction in ground wire surge impedance, (2) improved coupling between phase and ground wires, and (3) a reduction in magnetically and electrostatically induced voltages on phase wires.

### Adding Second Ground Wire

They described two methods of adding a second ground wire to 138-kv towers. One involved altering the tower head design so the second wire could be added beside the first; the other involved adding the second ground wire 10 ft below the first on the tower center line.

C. J. Miller, Ohio Brass, did not share the authors' view of the significance of surges induced by the release of bound charges. He felt they were too small to be important and did not occurr simultaneously with surges produced by stroke currents, so could not contribute to them. Julius Hagenguth, General Electric, said it is not clear whether the improvement from the second ground wire is due to improved coupling or lower surge impedance. Addition of the second ground wire at tower top appears better, said Hagenguth, than a lower position because it reduces tower top potential. R. Schlomann and W. S. Price, American Gas & Electric, found a second ground wire in vertical configuration less effective than a horizontal arrangement above phase conductors.

### Three Types of Flashovers

In an analysis of "anomalous" flashovers on 345 and 138-kv lines, C. J. Miller, Ohio Brass, recognized three types of flashovers; **1.** Conventional, usually involving flashover of the bottom insulator string of one tower, **2.** Shielding failures, where strokes terminate on top phase wires and produce matching flashovers on adjacent towers, and **3.** "Anomalous" flashovers distinguished by top or middle phase flashovers on only one tower. Miller emphasized that "anomalous" flashovers are marginal surges with crest values just sufficient to cause flashover, and that the voltage across a given string of insulators is determined by the line's geometric configuration and stroke characteristics. Under his hypothesis, the advantage of two ground wires is explained in large part by increased coupling between top phase wires and ground wires, and a decrease in ground wire surge impedance.

An analysis of magnetic fields produced around a transmission tower by lightning current, by J. G. Anderson and J. H. Hagenguth, General Electric, has shown that all measurements of tower currents using magnetic links to date must be re-appraised. Magnetic fields around towers were measured as a function of location and shown to differ greatly from the fields of isolated leg sections.

In a related study, I. B. Johnson, General Electric, and W. S. Price and A. J. Schultz, American Gas & Electric showed that distribution of lightning currents among towers and ground wires is affected by the wave shape of the stroke. They found that currents flowing in tower legs are a smaller proportion of total tower current than was considered in the past. They warned that considerable caution must be used when estimating crest current of a stroke by adding maximum values in different parts of the system.

Considerable interest and comment was drawn by a paper dealing with silicone compounds to control insulator flashover due to contamination. Joint laboratory and field tests reported by A. D. Lantz, Ohio Brass Co, and J. E. Conner, Southern California Edison Co, demonstrated the effectiveness of a heavy silicone compound (grease) over fluid silicone preparations. Although silicone grease picks up more deposits and soluble salt than other coating compounds, it gives superior surface resistance and ability to reduce radically currents flowing over moist contaminated surfaces. Experience at three 66-kv substations of Southern California Edison and a 220-kv switchyard indicates service life of coatings is about one year.

### Silicone Grease Advocated

Voluminous discussion developed general confirmation of the superiority of silicone grease over fluid in combatting contamination effects. But there was strong support for the practice of over-insulation in areas of widespread and persistent contamination. D. R. Hoopes, Southern Nevada Power Co, reported 66-kv insulators quieter and washing hazards eliminated with silicone grease coating. L. W. Combe and T. F. Barnes, Detroit Edison, said their findings were in complete agreement with the paper for 120-kv grounded-wye equipment. H. L. Rordon, American Gas & Electric, found silicone grease better than wax or wetting agents. R. L. Jenner, Lapp Insulator, urged investigation of comparative economies of over-insulation vs repeated treatment.

In analyzing characteristics of lightning strokes, C. F. Wagner and A. R. Hileman, Westinghouse, con-

# Flashover Rates Still Puzzling

cluded that time to crest of lightning currents of the order of 20,000 amperes exceeds 2 microsec. They also found that upward leaders are more likely to develop from towers than from level ground. But conditions under which they form are not understood. Transient arc characteristics of return stroke introduce a series voltage in the arc path of an inductive nature in that it is proportional to rate of change of current.

In a related paper, C. F. Wagner, C. M. Lane, and C. M. Lear, Westinghouse, presented results of tests on oscillatory arcs having crest values of 56,000 amp and times to crest of 1.2 microsec. They sought to find whether transient voltage drop of high-current arcs is an important factor in the character of lightning stroke currents. Apparently it is, for they pointed out that initial discharges have very high voltage drops ranging from 20 to 40 kv per in. lasting 0.2 microsec and followed by longer-duration, but still high, voltage drops of 1 to 4 kv per in. Thus, with a drop of 3 kv per in. a 100-ft arc would have a drop of 3,600,000 v. And with stroke potentials of 10 to 50 million v a few 100-ft lengths would have a significant effect on characteristics.

#### Radio-Influence Sources

Suspension clamp U-bolts are the principle source of corona and objectionable radio influence voltage in unshielded bundled conductor assemblies. Yoke plates are another important source; insulator keys and connecting hardware are other sources. Good shielding, however, can cut RIV of bundle conductor single-string assemblies 80% and double-string assemblies 50%, according to Joseph Kaminski, General Electric, in a study of 345-kv systems.

Incipient radio-influence voltages from point protrusions on the surface of bundle conductors depend on their location on the conductor. RIV is inversely proportional to local conductor surface gradient, and because surface gradients vary as much as 20%, part of the conductor can produce RIV while the other with similar imperfections can be completely quiet. Effect of these point protrusions was reported by T. W. Liao and P. A. Doyle, General Electric.

Excellent correlations between field tests and calculations of RI levels on five EHV lines in England, Sweden, France, Germany and the United States were reported by G. E. Adams and C. Concordia, General Electric, with W. S. Price, American Gas & Electric. Field measurements were made in 1955 by a team of AG&E engineers. Measurements showed American and French RI levels nearly the same. Level of the Swedish line is lower by a factor of 2:1 at 100 ft and 4:1 at 250 ft. Lateral profiles were not taken for the German and English lines, but the English line was expected to be comparable with the Swedish line. The German line is expected to yield substantially lower levels. The authors established that noise level of a new line can be predicted accurately by methods already known, where varying conductor surface characteristics are taken into account.

#### High-Voltage-Cable Research

The electric power industry, rapidly outgrowing conventional bulk power transmission systems, has enlisted the aid of university research in an extensive high-voltage cable research program, said L. I. Komives, Detroit Edison Co. Komives, chairman of AEIC-EEI Steering Committee for Project 970, told of Cornell University tests on 345-kv underground cables.

A testing station, he said, will be erected next year near the high-voltage laboratory where cables can be installed for field tests under simulated service conditions. Two to four 500-ft cable samples, having necessary joints and terminals, will be tested. Cables suitable for 345-kv service and capable of carrying loads of 450 Mva or greater will be supplied.

Field testing at Cornell, to start in the fall of 1959, is scheduled for three years. The committee's specifications require determination of load carrying ability and long time stability of the cable under accelerated operating conditions. In the third year, conditions will be made so severe that accumulative heating and failures will occur.

# Substations: Potential Device Transistorized

- **New device for use with 46-kv breaker economically obtains instrument and protective relay voltages**
- **Also discussed: gas-insulated transformers; mobile substations; sulphur-hexafluoride breakers; arresters**

A transistorized bushing potential device for use with a 46-kv circuit breaker has been developed to provide an economical means of obtaining instrument and protective relay voltages from power transmission systems. It was described by R. L. Stauffer, Canadian Westinghouse, and E. O. Shepard, Westinghouse Electric Corp.

The relatively small device includes a power supply, input circuits, and four transistor amplifiers. An application described by the authors involves amplification of input signals obtained from taps on the condenser bushings of a 46-kv breaker. The device's output voltages, proportional to system line and zero sequence voltages, energize the

directional element potential coils of induction-type overcurrent relays. Power for the amplifiers is obtained from a remote operating transformer and a current transformer in the breaker.

As a preliminary basis for establishing standards for gas-insulated transformers, the values in the accompanying table were recommended by G. Camilli and R. E. Coates, General Electric Co.

When gas-insulated transformers are protected with modern lightning arresters, the authors said, it appears that basic insulation levels (BIL) can be safely reduced one step below the normal BIL for liquid-insulated units. At the same time, full standardized low-frequency high-potential tests can be maintained, with considerable safety margins at both lightning and switching surge conditions.

Most companies do not provide special facilities for connecting mobile substations to distribution, according to a survey of 32 companies. Positioning and connecting of mobile units usually are left to field forces in emergencies. The job can be facilitated by past experience in installing units in stations, but the information is seldom recorded or incorporated in a permanent guide.

Time for installing a mobile transformer varies from 1 to 24 hr, according to A. F. Phillips, Duquesne Light Co. About 50 of the 78 units reported can be installed in 6 to 8 hr.

To save time, particularly in emergencies, advance plans should be prepared and connection facilities provided for mobile units wherever they may be needed, said M. R. Wallin, Union Electric Co. He said that roof bushings are provided on the low-voltage bus-tie compartments at some subs for connecting mobile units. On similar metal-clad gear now ordered, roof bushings have been replaced by receptacles for portable cables. The mobile sub can be plugged into the bus-tie or feeder position.

Substation standards really pay off in savings of manhours in engineering, design, detailing, and construction, declared B. T. Payne, Central Maine Power Co. An additional benefit is the elimination of errors, particularly in steel structures.

Sulphur-hexafluoride breakers repeatedly cleared 115-kv line-charging current and interrupted ½-million-kva faults on the Gulf Power Co system, reported E. B. Henry of that utility and R. E. Friedrich and F. L. Reese, Westinghouse. Clearing times ranged from 1.75 to 2.35 cycles in staged line-clearing tests, consistently without restrikes. Faults cleared in 2.7 cycles without significant rise in gas pressure.

Reese said the breakers have switched single and multi-bank capacitors without restrike and that the $SF_6$, over five times the density of air, can be poured in the top of the breaker after field inspection. Subsequent performance was identical to that of vacuum-filled units.

Metal-enclosed, isolated-phase bus enabled Consolidated Edison Co to build a practical and economical 4-terminal, 4-transformer, 138-kv substation on a 62 x 162-ft plot at its East River Plant, said R. H. Albright, I-T-E Circuit Breaker Co. Ultimate development will occupy four distinct levels from 138-kv cable terminals on the bottom to tie breakers and isolating switches on the top.

## Coordinated Protection of Gas-Insulated Transformer by Magne-Valve Lightning Arresters

(Station-Type)

| System Operating Voltage Class Kv (rms) | Arrester Rating Max. Line to Ground Kv (rms) | Arrester Rating in Percent of Max. System Voltage | Arrester Protection Level Kv-Crest: Max. Switching Surge Spark Over Voltage Kv-Crest | Arrester Protection Level Kv-Crest: Max. IR Voltage for Discharge Current of 10,000 Amps | Transformer Test Voltages: BIL and Full Wave 1½ x 40 Kv-Crest | Transformer Test Voltages: Low Frequency 60 Cycle Kv-rms | Transformer Switching Surge Withstand Voltages Kv-Crest |
|---|---|---|---|---|---|---|---|
| 8.7 | 6 | 80 | 18 | 18 | 75 | 26 | 64 |
| | 9 | 100 | 26 | 27 | | | |
| 15 | 12 | 80 | 34 | 36 | 95 | 34 | 81 |
| | 15 | 100 | 42 | 45 | | | |
| 34.5 | 30 | 80 | 83 | 88 | 150 | 70 | 130 |
| | 37 | 100 | 98 | 102 | | | |
| 69 | 60 | 80 | 163 | 175 | 250 | 140 | 230 |
| | 73 | 100 | 195 | 210 | | | |
| 115 | 97 | 80 | 260 | 280 | 450 | 230 | 400 |
| | 121 | 100 | 324 | 350 | | | |
| 138 | 109 | 75 | 292 | 315 | 450 | 230 | 405 |
| | 121 | 80 | 324 | 350 | 550 | 275 | 495 |
| | 145 | 100 | 388 | 420 | 550 | 275 | 495 |

## Proposed Arrester Tests Are More Severe

| Arrester: Type and Voltage Rating | Duty Cycle Test Impulse Current, Crest Amp | Low-Current Long-Duration Test: Current, Crest Amp | Low-Current Long-Duration Test: Duration Microsec | High-Current Short-Duration Test Current Crest Amp |
|---|---|---|---|---|
| Station: | | | | |
| 3 to 242 kv..... | 20,000 (10,000) | 650 (150) | 2,000 | 100,000 |
| Intermediate (Line): | | | | |
| 3 to 121 kv..... | 10,000 (5,000) | 200 (75) | 2,000 (1,000) | 100,000 (65,000) |
| Distribution: | | | | |
| 3 to 18 kv..... | 10,000 (5,000*) | 200 (75*) | 2,000 (1,000*) | 100,000 (65,000) |

Present standard values different than proposed values are in parentheses.
*Valve arresters only.

Design requirements of 1,200-amp continuous rating, 60,000-amp momentary, with 310-kv 60-cps withstand and freedom from corona or static discharge at 85 kv to ground were satisfied with taped conductor centered in 80-in. cylindrical housings. Critical impulse strengths were found to be 650-kv positive for the taped bus and 580-kv for the bare section required at switch points, Albright reported. The housing is of rolled and welded aluminum with neoprene-gasketed joints and manholes.

### More Severe Tests Advised

More severe tests of lightning arresters are advisable, said G. F. Lincks, GE, to match today's expanding systems. Ability to withstand greater magnitudes and durations of switching surge currents is a dominating requirement of station arresters on higher voltage transmission lines. Thus Lincks suggested a test to determine the maximum length of line or cable each voltage rating of arrester can discharge.

Lincks cited recent data which indicate tests on station arresters should be boosted to 20,000-amp. Distribution and intermediate (line) arresters should withstand a 10,000-amp duty cycle.

Arrester designs have been improved so that higher withstand test values may be considered. Lincks proposed that the 20 low-current long-duration rectangular wave tests should be 650 crest amp for 2,000 microsec for station arresters and 200 amp for 2,000 microsec for intermediate and distribution arresters. Higher voltage systems with long lines may need special station arresters to withstand more severe switching surges, he said.

All distribution valve and expulsion arresters, intermediate arresters, and station arresters should be tested with a 2-shot, 100,000-amp impulse using a 5x10-microsec wave. Laboratory results show that station arresters which meet the proposed higher test requirements will pass a 150,000-amp test, Lincks said. Discussion of these proposed higher ratings generally questioned whether they are representative of conditions on present systems.

Multiple restriking of a 196/220-kv 5,000-Mva breaker produced switching surges which damaged the breaker interruptors and destroyed two 182-kv station arresters on the 220-kv system of Pennsylvania P&L Co, reported M. Galiyano. After network analyzer tests showed that breaker shunt resistors would control restrike voltage, these resistors were applied. The arresters were destroyed by cumulative heating caused by repetitive discharges of switching surge and power-follow current.

H. Linck, Ontario Hydro, said field tests on his system bear out the use of capacitive resistors as applied by Galiyano. But A. G. Yost, Ohio Brass, said the unique combination of occurrences may have caused the failures on the PP&L system. A thorough investigation of all system components was needed. L. G. Frederick, Westinghouse, said an oil-driving pump would have limited breaker operation to one restrike.

A. Schultz and L. Barthold, GE, suggested the PP&L arresters would not have failed had they been designed to meet the tests proposed by Lincks. A. E. Kilgour, Allis-Chalmers, said an oil pump has no control over the overvoltage produced during breaker restrike while capacitive resistors hold the over-voltage to a reasonable and harmless value.

### New Arrester Field Test

Faulty arresters are found with a new field test method which reliably indicates critical sparkover, reported H. Linck, Ontario Hydro. Of 785 line and 325 station units tested, 10% were found with poor sparkover performance. The equipment produces an impulse with times to voltage crest from 5 to 10 microsec and maximum output of 250 kv. A transient crest-voltmeter eliminates need for an oscillograph. An ac-leakage test performed by the test equipment helps detect faulty arresters. The equipment and a two-man crew can operate in almost any field location, said Linck.

# Relays: High-Speed Reclosing at 345 Kv

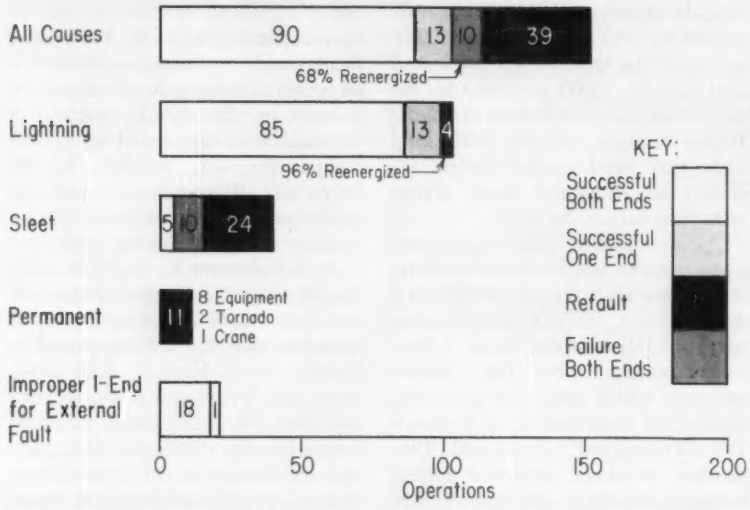
- **In two-year test, American G&E finds high-speed reclosing especially successful for lightning flashovers**
- **Also discussed: operation, performance, and application of new compensator distance relaying scheme**

Experience for over two years with high-speed reclosing of 345-kv lines was reported by H. C. Barnes, A. Hauspurg, and J. H. Kinghorn, American Gas & Electric Service Corp. This experience pertains to 20 lines on double-circuit steel towers, some of which are strung with only one circuit. Both circuits of some double-circuit lines are switched in unison.

Reclosing time for these circuits is 28 cycles, based on 15,000 amp as reasonable maximum short circuit for a high percentage of possible faults. Full capacitive coupling arcing time was not included.

During the two years there were 152 operations (see graph on p 80). Overall record of 90 successful reclosures appears poor. However, elimination of terminal equipment failures by improved design, adjustment period problems, etc, indicates success as good as or better than the 138-kv record. For example, high-speed reclosing was especially successful for lightning flashovers, indicating that the reclosing time is adequate and might be shortened. Perfect success was realized with double-circuit flashovers, the greatest hazard to the system.

AG&E authors also stated that coupling voltage may have a detrimental effect in view of the few refaults following lightning flash-




**HIGH-SPEED RECLOSING OF 345-KV LINES on double-circuit steel towers proved successful on the American G&E system. Two years experience is plotted here**

overs of one circuit while the other circuit remained energized. Under sleet conditions the record was disappointing.

Discussion brought out that Westinghouse Electric engineers extrapolated data on de-energization time for lower voltage lines from a number of references. Extrapolation to 345-kv showed that 25 cycles of de-energization would be adequate.

Operation, performance, and application of a new compensator distance relaying scheme were presented in these three papers by Westinghouse engineers:

**1.** W. K. Sonnemann and H. W. Lensner said that the new scheme derives its name from air-gap transformer compensators. With current-energized primary windings and voltage secondary windings the compensators provide current-derived voltages that are subtracted from system voltages at the relay location. Net voltages are applied to a high-speed induction cylinder relay unit that develops either closing or opening torque, depending on type and location of the fault.

Two sets of compensators and two induction units are packaged to make up a complete relay. One relay unit responds to all phase-to-phase faults; the other, to three-phase faults. Either will respond to two-phase-to-ground faults.

**2.** W. E. Rich and H. J. Calhoun said that the compensator permits a minimum of moving parts to perform a multiplicity of functions. Moreover, the compensators permit greater accuracy in relay tap values, in percentage of change between taps, and in linearity. The compensator, having no transient response, may be set without regard to overreach. Minimum reach is 0.75 ohm, but components can be added to reduce it.

**3.** H. W. Lensner, P. J. Schwanenflugel, and W. L. Hinman showed how the following components would be used for one terminal of distance carrier relaying: Separate compensator distance relays for zone 1 and 2 tripping, modified compensator relay for zone 3 and carrier function, time-delay relay for zone 2 and 3 time delays, directional overcurrent ground relay, carrier auxiliary relay, and optional out-of-step blocking relay.

The compensator distance relay and other components simplify carrier control and trip circuits of the three-zone distance carrier relaying system, they said. There are fewer contacts in the complete relaying system. Moreover, because a single design of high-speed relay unit is used for all ac types of measurement, coordination is simplified. Ample time margin for proper coordination of relays results from careful attention to operating and resetting time of protective and auxiliary relay units.

# Generation: A New Look at Reserves

- **New method for determining reserve capability uses probability methods to predict forced-outage data**
- **Also discussed: economical dispatch; protection of a supercritical-pressure unit; use of digital computers**

A new method for determining reserve generating capability was proposed by H. Halperin and H. A. Adler, Commonwealth Edison Co. A feature of the method is that reserve capacity is established by determining expected frequency, interval, and duration of forced outages of generating capacity independent of load by probability methods. Most utilities use a method in which the amount of reserve selected is related to peak load.

Several discussers saw advantages in the method because it not only establishes the frequency of occurrence but also the duration of outage and intervals between outages. It was pointed out that an outage of one day in 100 has the same outage percentage as 5 days in 500 but the longer outage may present the utility with a more acute problem.

The basic approach to the reserve study was:

**1.** Determine by probability meth-

ods the expected frequency and duration of forced outages of generating capacity.

**2.** Schedule overhauling according to the "constant risk" principle.

**3.** Evaluate required reserve capacity on the basis of estimated 12 monthly peak loads in a year instead of yearly maximum demand only.

**4.** Determine a monthly peaking factor to take into account the effect of variations in weekday daily peaks within each month on the required reserve.

**5.** Evaluate help during emergencies from power supplied by other utilities, from emergency loading of generating-station equipment, and from dropping interruptible loads.

**6.** Establish criteria of reliability on the basis of frequency of emergencies which the system must meet without voltage reduction or loss of load.

The accompanying table shows the results of this approach for a system with an average monthly peak of 4,660 Mw.

**Reserve Generating Requirements, Mw**

Peak loads: Annual—4,660; Average monthly—4,460

| Frequency of forced outage | One a month | One in 6 months | One a year | One in 5 years | One in 25 years |
|---|---|---|---|---|---|
| (a) Requirements for forced outages | 380 | 590 | 665 | 805 | 935 |
| (b) Emergency help | | | | | |
| Interconnections | 80 | 240 | 310 | 360 | 450 |
| Emergency loading | 0 | 90 | 135 | 135 | 135 |
| Interruptible load | 50 | 50 | 50 | 50 | 50 |
| Subtotal | 130 | 380 | 495 | 545 | 635 |
| (c) Monthly peaking factor | 65 | 65 | 65 | 65 | 65 |
| (d) Net requirements for forced outages (a-b-c) | 185 | 145 | 95 | 195 | 235 |
| (e) Required owned reserve (d+overhaul) | | | | | |
| Average for year (overhaul-480 Mw) | 665 | 625 | 575 | 675 | 715 |
| August (overhaul-135Mw) | 320 | 280 | 230 | 330 | 370 |
| December (overhaul-370 Mw) | 555 | 515 | 465 | 565 | 605 |

### Two Dispatch Computers

AIEE members heard progress reports on two operating economic dispatch computers. Both, in service for a year or more, have given satisfactory service. Ohio Edison Co's automatic economic computer-controller, commonly referred to as "GEDA", has proved quite effective even during rapid load change periods, according to R. H. Travers.

Initially, the computer was switched off during early morning pickup and late evening drop off. But as dispatchers became more familiar with GEDA's operation, they began using it during these periods and found that it could do a better job of adjusting the system generation than they could. Total pickup of 160 Mw in 15 min has been economically accomplished.

### GEDA's Accuracy Proves High

Travers said that the overall availability of the equipment for the first nine months of 1957 has been about 92½%. GEDA's accuracy has been such that the errors in Mw are less than the guaranteed accuracy of the telemetering equipment supplying input data.

Equally successful results have been obtained with West Penn Power's economic dispatch computer. According to W. H. Osterle, the design has been satisfactory and the operation all that could be expected. And the true measure of success is the fact that the dispatchers like it.

Osterle told his audience that computer outage time was about 3%. He indicated that very reliable servomotors and simple amplifiers contributed to this high availability. Tube failures have been so small that a tube replacement program was not needed.

Discussion brought out considerable interest in initial costs and possible savings. Travers indicated that actual savings in dollars for the Ohio Edison computer were difficult to evaluate because it would entail comparison with the abandoned dispatching system. Nevertheless he was confident that the computer would pay for itself in two years originally estimated.

### $50,000 Saved in Year

West Penn Power engineers resurrected the old method of dispatching and compared its results with those of the computer on nine typical days. The study showed a cost savings of about $50,000 for the computer for the first year of operation. Contract price of the computer was $100,000. Osterle indicated that a change in computer constants necessitated by the addition of a new generating unit would cost about $2,000.

Basically, overall trip protection for a supercritical pressure turbine and steam generator is not radically different than that for a large subcritical unit. R. F. Willet, Cleveland Electric Illuminating Co, bases this conclusion on the design for CEI's new 3,500-psi Avon unit. However transfer of selected auxiliary motors to the start-up source becomes more important. The boiler by-pass system, used with the once-through type steam generator required with a supercritical pressure cycle, is the main reason why electrical transfer of auxiliaries takes on added significance.

Some of the more important auxiliaries that will be transferred at Avon include:

**1.** Condenser circulating pumps—to condense and cool steam bypassed into the condenser.

**2.** Boiler feed pumps—to provide desuperheating water to the by-pass system and to set up the feedwater system for a hot boiler restart.

**3.** BF booster pumps—to provide sufficient head for the feedwater pumps to prevent cavitation.

**4.** Condensate pumps—to provide injection seal water.

**5.** Service and sluice water pumps—to provide bearing and cooling water.

**6.** ID and FD fans—to provide boiler air purging.

### Transferring Plant Auxiliaries

A new 5-cycle, 4.16-kv metalclad breaker should provide plant designers with another means of adequately transferring power plant auxiliaries. The high-speed closing characteristics of this breaker (solenoid mechanisms require about 15

cycles) is provided by energy from a small operating motor. This energy is stored in springs capable of closing the contacts of the breaker at the required speed for no-load and fault conditions within rating.

A computer study made by General Electric engineers indicates that use of the breaker in certain transfer schemes practically eliminates problems of voltage dip, excessive shock to motors on interrupted-circuit transfers, and boiler instability caused by long motor recovery times. Two types of transfers were considered: Giving a signal to trip one source breaker and close the second source at the same time, and delaying closure of the incoming breaker until a contact on the tripping breaker indicates a tripping.

Leading off the session on digital computers as tools for system engineering was a report by H. B. Seeley, R. E. Briesemeister, and J. T. Garbarini, Consolidated Edison Co. A comprehensive program for a maximum of 60 buses and 70 circuits for the IBM 705 permitted a quick, thorough analysis of power system transfer capability during generator outages. Little manual effort was needed for data preparation and evaluation of results. The computer itself analyzed and summarized the results and selected a small number of limiting cases for presentation in complete detail, said the authors.

Cost of load flow studies on a large system is reduced up to 75% with a IBM 704 computer over cost of a network analyzer at standard rental charges, said H. P. St. Clair and G. W. Stagg, American Gas & Electric Service Corp. Power flow calculations were made for the entire 138-kv and 345-kv interconnected AG&E system (EW, Sept 30, 1957, page 60), several portions of the system, and an underground network. One advantage of digital computer use is the fact that studies can be stopped and started without a cost penalty. A common base of 100 Mva is satisfactory for all systems, ranging from 345-kv transmission to 120/208-v secondary networks. Distribution to utilities of the program used by AG&E will be handled through IBM.

# Industrial: New Formulas for Voltage Drop

- **Forthcoming AIEE Grey Book will give simplified formulas for computing the voltage drop in buildings**
- **Also discussed: application of ac network analyzers in plants; tying industrials with utilities; house heating**

Citing the need for a more reliable method of determining ac voltage drop in industrial and commercial systems, R. A. Erwin of the Los Angeles Dept of Water & Power proposed studies on a large number of existing systems. In preparing a section on voltage drop in commercial buildings for the forthcoming AIEE Grey Book, Erwin reduced 28 3-phase ac formulas in the Red Book to two simple equations:

$E = [(21 - A) + 0.000053]$ IL for single conductors in magnetic conduit;

$E = [(21 - A) + 0.000028]$ IL for single conductors in non-magnetic and 3-conductor cable in any conduit.

Within very narrow limits the formulas are said to be as reliable as the data from which they were derived. A single-phase counterpart for balanced 3-wire circuits using line-to-line voltage to determine current or for 2-wire circuits using line-to-neutral voltage to determine current is $E_1 = 1.155\ E_3$.

As the trend toward greater reliability and service continuity for automated plants makes it imperative to anticipate electrical system behavior under both normal and emergency conditions, the potential applications of the ac network analyzer in industrial plants are increasing. C. C. Young and J. Dunki-Jacobs, General Electric Co, said such studies can be used advantageously in short-circuit current problems; in load-flow problems resulting from load growth; sizing reactors and determining optimum transformer impedances; voltage dip or flicker problems caused by large motors; and setting up voltage-shedding programs for loss of generation.

In studies of transient stability in industry, the relatively long clearing times, compared with times on utility systems, have been the major cause of instability.

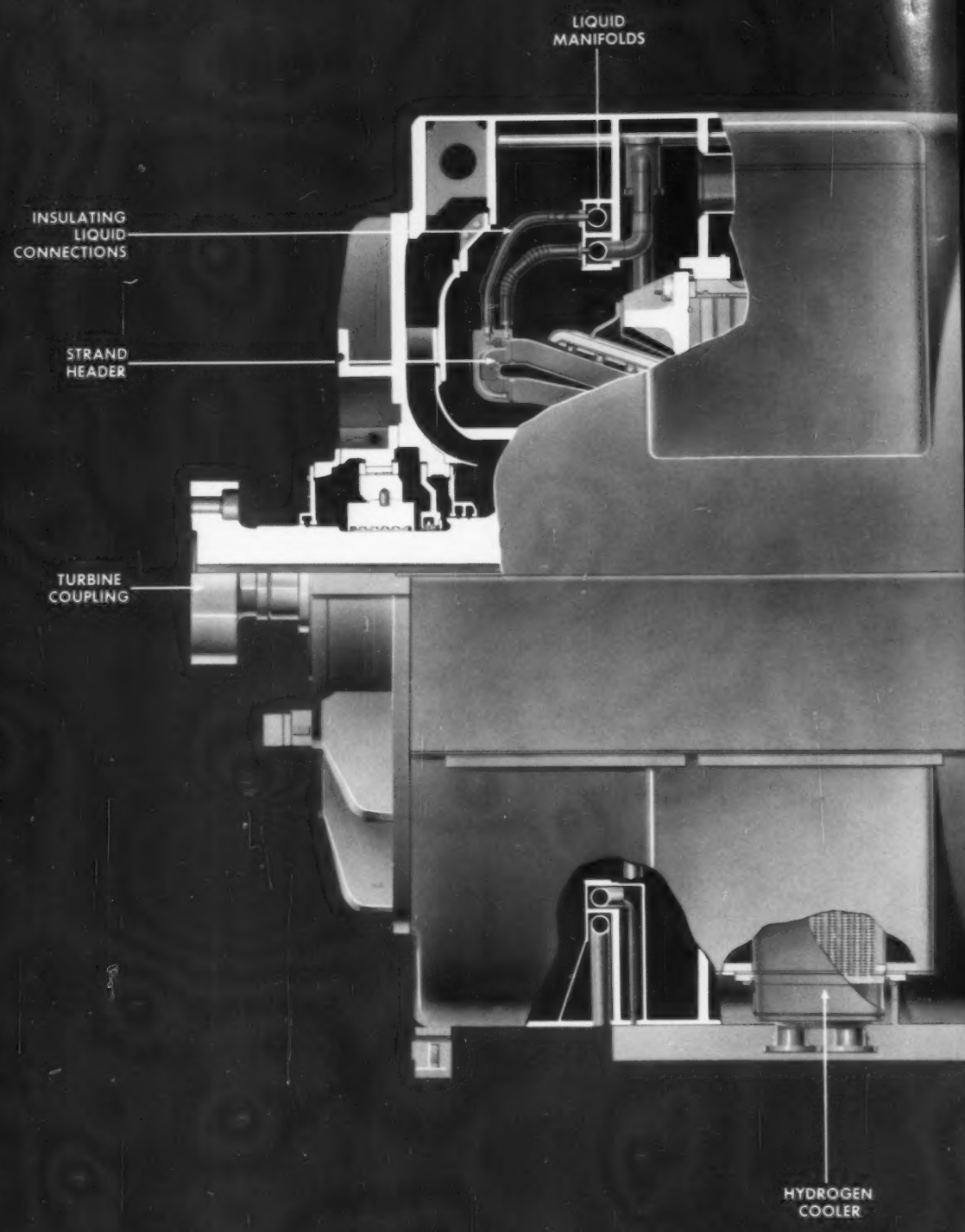
In comparing alternate methods of tying with utilities, T. W. Haymes and R. B. Thompson, Shell Oil Co, pointed out that designers tend to duplicate excessive amounts of electrical equipment in refineries, meanwhile forgetting that overall reliability can never be greater than that of the utility system serving the plant. Because excessive duplication can cause trouble, the current effort in Shell properties is to simplify ties with utilities as much as possible.

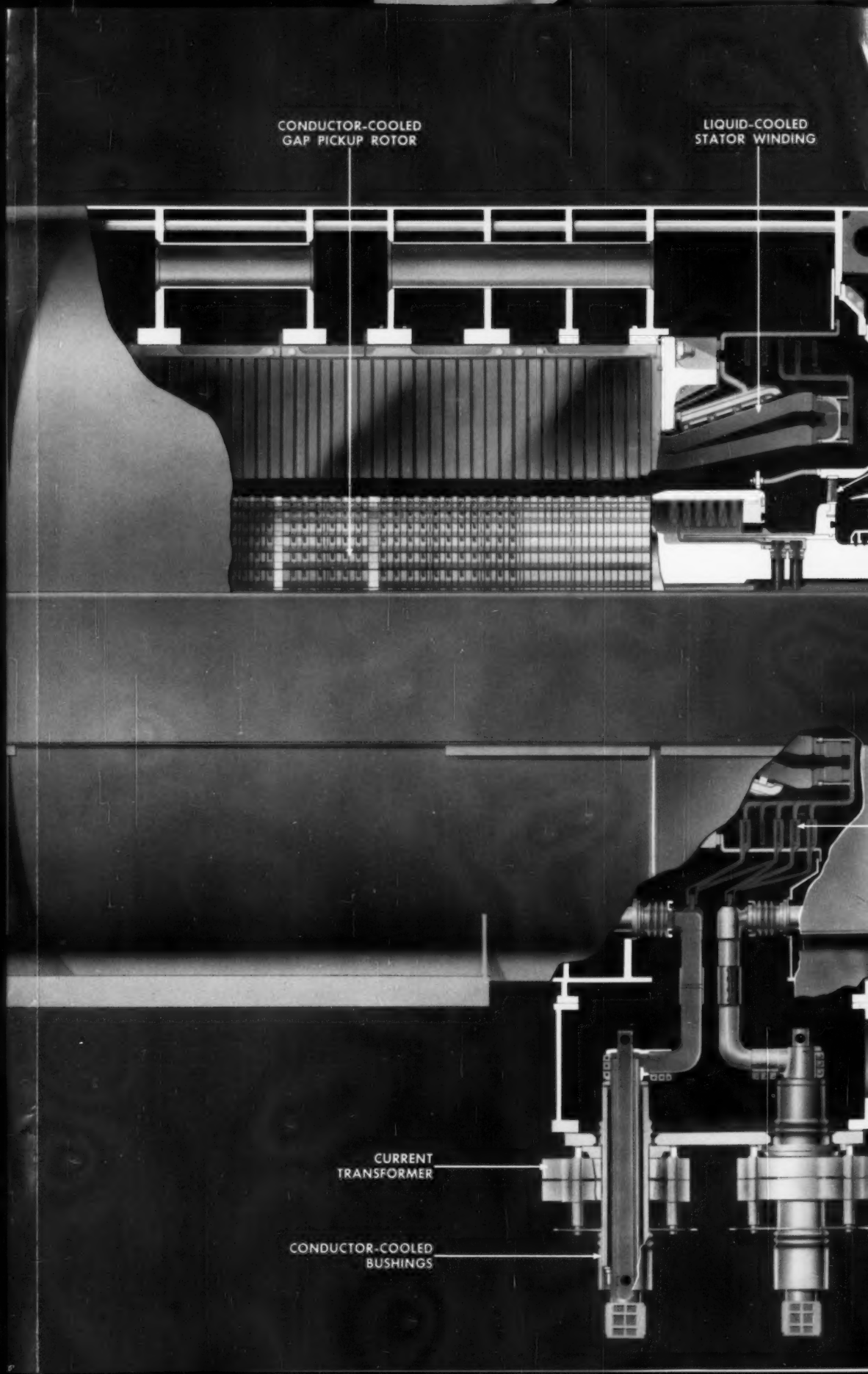
Commenting on this report, W. H. Dickinson, Esso Standard Oil Co, stated that a company can afford to spend two to three times the annual failure cost to improve its system.

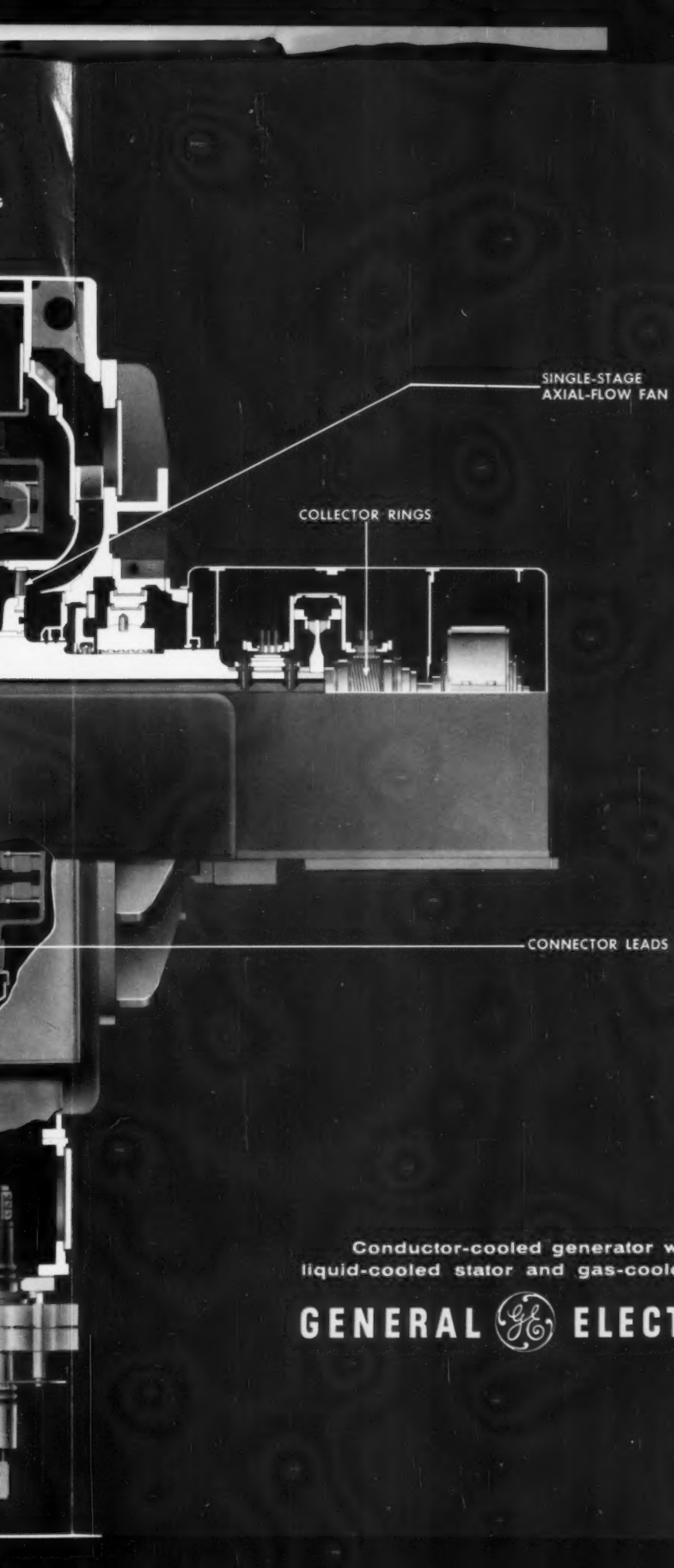
### Heating Methods Compared

C. W. Jones and E. E. Linden, Narragansett Electric Co, after a one-year comparison of alternate operation of a heat pump and heating cable in the same residence, concluded that outdoor air temperature is the dominant weather factor affecting heating.

The heat pump was a nominal 3-ton central machine, rated 42,000 Btu per hr on 9 gpm of 50F water. The condensing unit was rated at 3 hp. In the 1956-57 heating season, the radiant ceiling units consumed 24,007 kwhr while the heat pump used 11,432 kwhr.

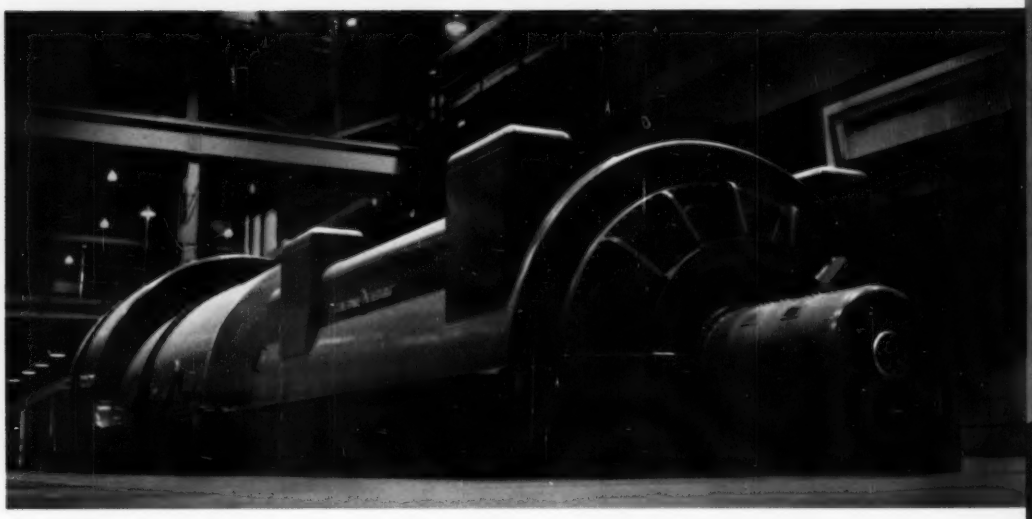

LIQUID MANIFOLDS
INSULATING LIQUID CONNECTIONS
STRAND HEADER
TURBINE COUPLING
HYDROGEN COOLER


CONDUCTOR-COOLED
GAP PICKUP ROTOR
LIQUID-COOLED
STATOR WINDING
CURRENT
TRANSFORMER
CONDUCTOR-COOLED
BUSHINGS




Conductor-cooled generator with
liquid-cooled stator and gas-cooled rotor

GENERAL ELECTRIC



# LIQUID COOLING

## . . . key to higher generator ratings

The successful application of liquid cooling to generator stators has ushered in a new era in the design and construction of large turbine-generators. No longer is the stator winding thermal barrier the primary determinant of size and rating. Now, the door is open to generator designs conceivably as high as 1,000,000 kva!

With almost double the rating now possible within the same frame size, significant savings in power plant construction costs can be realized. In addition, higher-rated generators can be built and installed within the limitations on size imposed by shipping restrictions.

A high level of operating efficiency and reliability has been demonstrated by the commercial performance of General Electric liquid-cooled generators. And along with their many improvements, these units have retained the design simplicity and flexibility needed to meet individual operating requirements.

Some of the more important features which contribute to this outstanding performance are described on the following pages.

GENERAL ELECTRIC

GENERAL ELECTRIC'S DR. G. V. BROWNING AND C. H. HOLLEY DISCUSS FUTURE APPLICATION OF WATER COOLING

# *ON THE HORIZON* . . . WATER COOLING

The successful application of liquid for cooling stator windings is progressing to even greater advances.

Up to the present, transil oil has been used as the coolant because of its high dielectric strength, good cooling properties, and its chemical inertness. Water, however, has over twice the heat removal ability of oil! It also has the advantages of non-flammability and availability. It is the most promising coolant for tomorrow's larger generators.

**RELATIVE HEAT REMOVAL ABILITY OF COOLANTS**

| | |
|---|---|
| AIR | 1.0 |
| HYDROGEN 30 psi | 3.0 |
| TRANSIL OIL | 21.0 |
| WATER | 50.0 |

Over two years of operational testing on the water-cooled generator simulative equipment shown above have proven that it is practical to maintain dielectric properties of water required for its use in large generators. Corrosion and erosion do not impose difficulties. Tests made to evaluate flashover and arcing showed that these characteristics would not present problems in a generator application.

Soon, when water cooling becomes an operating reality, generators can be built with ratings higher than are possible to attain today. This progress is still another example of how General Electric applied research is constantly looking to the future in an effort to meet utility needs of tomorrow.

Your nearest Apparatus Sales Office can furnish more details on liquid cooling and the development of water cooling. Or write for bulletins GER-1231 and GER-1478, Section 254-72, Large Steam Turbine-Generator Department, General Electric Co., Schenectady 5, New York.

*Progress Is Our Most Important Product*

GENERAL ELECTRIC

MEETING TOMORROW'S POWER DEMANDS

# General Electric liquid-cooled generators offer improved performance, greater reliability

Despite the tremendous increase in unit output now possible with liquid cooling of generator stators, the design simplicity and reliability of conventionally-cooled machines has been retained. Units may be operated and maintained following standard practice. And better control of the unit under variations in load is possible. Here are some of the more outstanding design features of these generators:

## MORE EFFECTIVE HEAT REMOVAL

In a liquid-cooled generator, the coolant flows directly through the tubular strands in the stator bar. This intimate contact between coolant and copper can remove up to 16 times as much heat as conventional methods . . . and does so with minimum temperature difference from copper to coolant. It also most efficiently uses stator slot space and simplifies stator bar internal insulation.

## SIMPLE, RELIABLE DIELECTRIC SYSTEM

The dielectric system of liquid-cooled stators remains basically as simple as for conventionally-cooled machines. Completely insulated, the liquid connections between the stator bars and the manifolds leave no exposed copper or creepage surfaces. And, since no insulation is required between the coolant and the copper, the simplest dielectric construction of the stator bar is possible.

## AUTOMATIC TEMPERATURE REGULATION

The liquid system permits generator load to be increased or decreased with minimum variation of stator winding temperature. Since the coolant is in direct contact with the copper, it cools the winding to within a few degrees of the liquid temperature. Therefore, by automatic regulation of the coolant temperature, average copper temperature can be kept essentially constant, practically eliminating thermal stress cycling on the insulation.

## IMPROVED ROTOR ACCESSIBILITY

Since liquid cooling of the stator bars eliminates the need for multi-stage fans and complicated end shield assemblies, the short inspection downtime and low maintenance costs of conventionally-cooled machines is retained. Standard assembly and disassembly techniques may be used and normal time cycles are easily maintained.

## CLOSED COOLANT CIRCULATING SYSTEM

Many unique features have been incorporated into the design of the closed coolant system to provide a permanently tight liquid circuit. The tubular strands which terminate at each end of the bar are joined by brazed connections; liquid connections to the manifold provide complete electrical insulation, mechanical flexibility and the long reliable life required for turbine-generator operation.

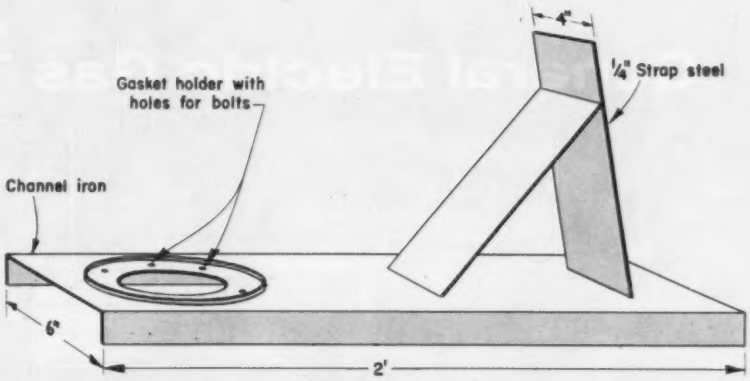
# Dust-Collector Tubes Replaced Faster

**D. W. ROBSON**, Maintenance Dept, Tidd Plant, Ohio Power Co, Brilliant, Ohio

Tidd Plant maintenance crews use a jig for pre-assembling dust-collecting tubes, gaskets, and bolts at any convenient place.

Besides increasing efficiency, this procedure eliminates transportation of loose materials to the dust collectors within which it is extremely difficult to assemble the tubes. Tube assemblies can be made before outages, thus easing manpower requirements during an outage.

The jig consists of a 2-ft piece of 6-in. channel iron with a flange-and-gasket holder near the assembler and a strap-steel support for the front of the tube at the far end. The flange gasket positioner has oversize holes through which the bolts are driven after the gasket and flange have been placed.




At the plant's request, the manufacturer of gaskets has been furnishing them with holes smaller than the bolt diameters. It had been found that man-hours could be wasted by maintenance men recovering and replacing dropped bolts during the installation or replacement of dust-collector tubes in the congested space inside the tube sheets. The smaller diameter bolt holes solved the problem of holding the bolts in the tube flanges.

But the smaller holes created a new problem. With the jig, bolts can be forced through the holes before the tubes are installed.

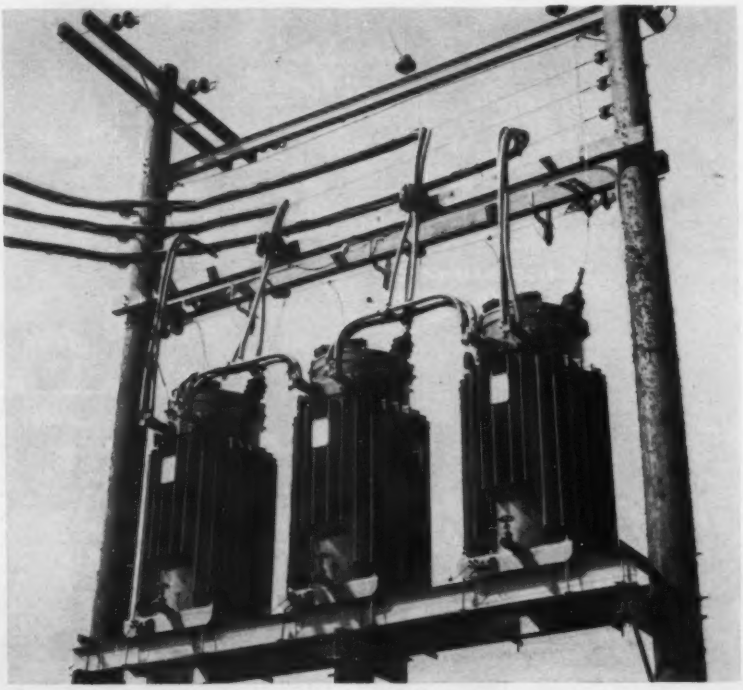
**DISTRIBUTION**—Design

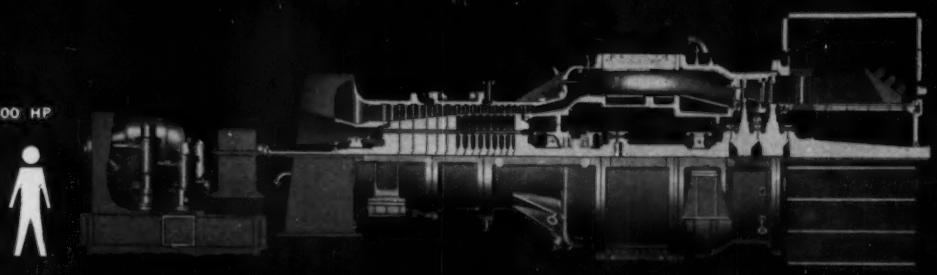
# Bundling Saves $500 for 3-Phase Bank

**GAYLE RILEY**, Senior Engineer, Engineering & Construction Dept, Alabama Power Co, Birmingham, Ala.

A new method of bundling bus and service at a two-pole platform structure which supports high-capacity transformers saves Alabama Power Co time and material. It eliminates the conventional secondary bus and permits running the multi-conductor secondary from the transformer to the customer. Be-

(*Continued on page* 95)

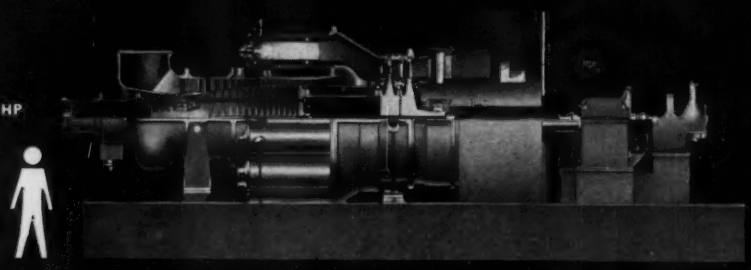




SIMPLE-CYCLE
16,500 KW; 22,500 HP

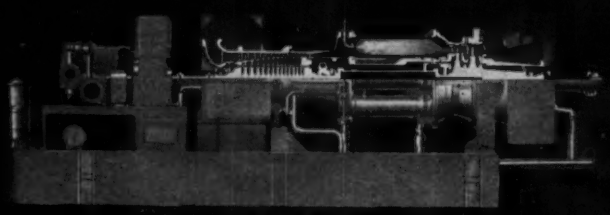
# General Electric Gas Turbines Log..

REGENERATIVE-CYCLE
15,200 KW; 20,900 HP

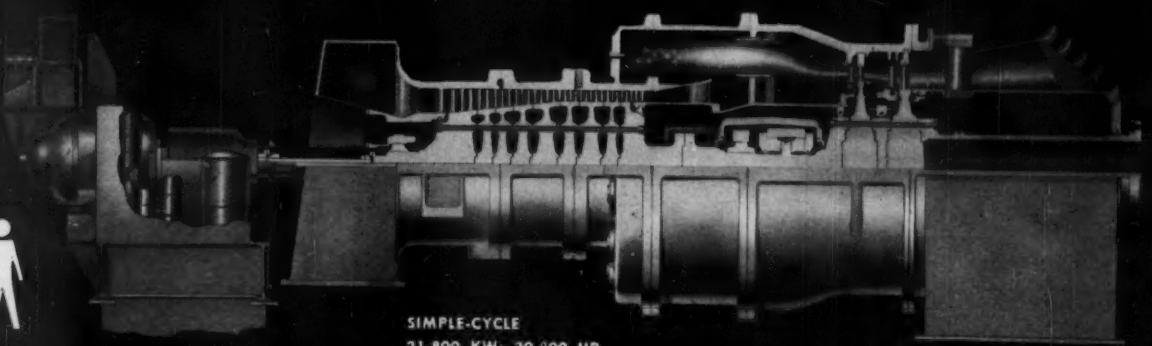


SIMPLE-CYCLE
9,500 KW; 13,400 HP

REGENERATIVE-CYCLE
5,400 KW; 7,600 HP



SIMPLE-CYCLE
5,300 KW; 7,500 HP



SIMPLE-CYCLE
21,800 KW; 30,400 HP

## OPERATING EXPERIENCE, WIDE RANGE OF RATINGS OFFER NEW OPPORTUNITIES FOR INCREASING USE

# Over 2,250,000 Operating Hours

Over two-and-a-quarter-million operating hours recorded by 135 units in a wide variety of applications—this is the unduplicated performance record that has established General Electric gas turbines as increasingly important powermakers.

**APPLICATION VERSATILITY** is one of the primary reasons for wide gas turbine acceptance. By providing power, exhaust heat, or combustion air for use in process or in combination with steam turbines, these self-contained prime movers are able to satisfy a variety of power requirements. A brief look at the chart on this page shows the varied industries using General Electric gas turbines.

**A BROAD RANGE OF RATINGS** is now available. Units range from 6,700 to 30,400 horsepower and 4,750 to 21,800 kilowatts. Because gas turbines are more compact than conventional power plants, building requirements are simple and limited space is required.

Proven by operating experience, versatile General Electric gas turbines stand ready—now—for even broader application. Whatever your power, heat or process requirements are, why not get all the facts on this important power plant. For more information, contact your nearest General Electric Apparatus Sales Office or write for GED-3546 (Gas Turbines for Industry), or GED-3603 (Gas Turbines for Electric Utilities), General Electric Company, Section 261-31, Schenectady 5, N. Y.

### GENERAL ELECTRIC GAS TURBINES POST IMPRESSIVE OPERATING RECORDS IN DIVERSE APPLICATIONS

| APPLICATIONS | NUMBER OF UNITS* | TOTAL EQUIVALENT HORSEPOWER* | OPERATING HOURS |
|---|---|---|---|
| GAS AND OIL PIPELINE | 88 | 574,800 | 1,185,000 |
| LOCOMOTIVE DRIVE | 58 | 462,890 | 500,000 |
| ELECTRIC UTILITY | 31 | 348,200 | 200,000 |
| PETROLEUM AND CHEMICAL | 20 | 191,450 | 50,000 |
| OIL FIELD | 16 | 155,400 | 300,000 |
| GENERAL INDUSTRIAL (steel, rubber, paper) | 5 | 76,200 | 10,000 |
| MARINE AND NAVY | 2 | 10,600 | 5,000 |
| TOTAL | 220 | 1,819,540 | 2,250,000 |

*General Electric gas turbines installed and on order as of February, 1958.

*Progress Is Our Most Important Product*

GENERAL ELECTRIC

**HIGHLY POLISHED SURFACE** of thrust bearing runner plate affords dependable operation of G-E hydro-generators. When completed, this bearing will support 3,816,000 pounds. Watching operator "stone" surface for smoothness are General Electric's R. B. Bodine (left), Mgr.—Large Generator and Converter Sales, and R. B. McKeeby, Mgr.—Mechanical Design Engineering, Large Motor & Generator Dept.

FOR MODERN SYSTEM PLANNING . . .

# Intensive development of hydro sites is an answer to "peaking"

Utility planning engineers find that intensive use of hydro-electric developments for supplying "peaking power" is an economic answer to relatively high investment costs for generating capacity. Hydro-electric sites with limited storage, or with the possibility of pumped storage, are being used effectively to supply "peaking power." General Electric hydro-generators driven by modern hydraulic turbines provide for all requirements of this type of application. One of the most important components contributing to the outstanding performance of these generators is the General Electric spring thrust bearing.

### RAPID START

Generating equipment for peaking service must be started and stopped each day, perhaps several times daily. General Electric hydro-generators driven by hydraulic turbines can be started and loaded as often and as rapidly as required. No involved starting procedures are necessary to insure satisfactory operation.

### OUTSTANDING RELIABILITY

Operating reliability of General Electric thrust bearings has been nearly perfect since this design was introduced in 1945. Since then, over 300 bearings have operated for more than 2400 machine-years with only 12 machine-days' outage during commercial operation due to thrust bearings. This is an average outage of only six hours per machine in fifty years.

### 3,816,000 LB. BEARING LOAD

As testimony of the great capacity of General Electric thrust bearings, the bearing pictured above will support a load of 3,816,000 pounds. In one installation, twelve similar bearings each carry a load of 4,000,000 pounds, a third more than the previous high which is also a General Electric installation.

For more information on how G-E thrust bearings can help you meet peaking requirements through the development of hydro-electric sites, contact your General Electric Apparatus Sales office or request bulletin GEA-2251E from General Electric Company, Section 301-376, Schenectady 5, N. Y.

*MORE POWER TO AMERICA*

GENERAL ELECTRIC

*General Electric Announces...*

# ALL-NEW WEATHER PROTECTED MOTOR

Wind, rain, snow, and even hurricanes, are little hazard to General Electric's *new* Weather Protected Motor—first major redesign of weather protected motors since their 1948 introduction.

General Electric's new design offers you the best outdoor protected drive available for your motor needs. Just install it, and don't worry about it when adverse weather strikes.

**ALL-WEATHER PROTECTION** built in the new design is the result of a unique top intake and exhaust ventilating system which utilizes a labyrinth baffling system to remove contaminants before air reaches motor interior. Incoming air is required to make a series of right-angle turns and reductions in velocity before entering motor interior.

The new design, developed in G.E.'s Medium AC Motor and Generator Dept. to meet or exceed NEMA Type II definition, has passed a series of "hurricane tests," during which tons of water were hurled on the motor at wind velocities up to 100 mph. At completion of tests no moisture had entered the motor interior. Danger of pressure build-ups during severe storms is reduced by special "blow-through" passages for high velocity winds.

**FOR MORE INFORMATION** on this modern motor design, consult your nearby G-E Apparatus Sales Office or write to Medium AC Motor & Generator Dept., Section 882-7, General Electric Co., Schenectady, N. Y.

**BETTER PROTECTED AIR OPENINGS**—"High up" air intake passages of new G-E motor prevent snow, trash, dust or dirt from being drawn into motor. Passages do not clog. Side intake and end exhaust prevent recirculation, allowing side-by-side mounting with minimum spacing.

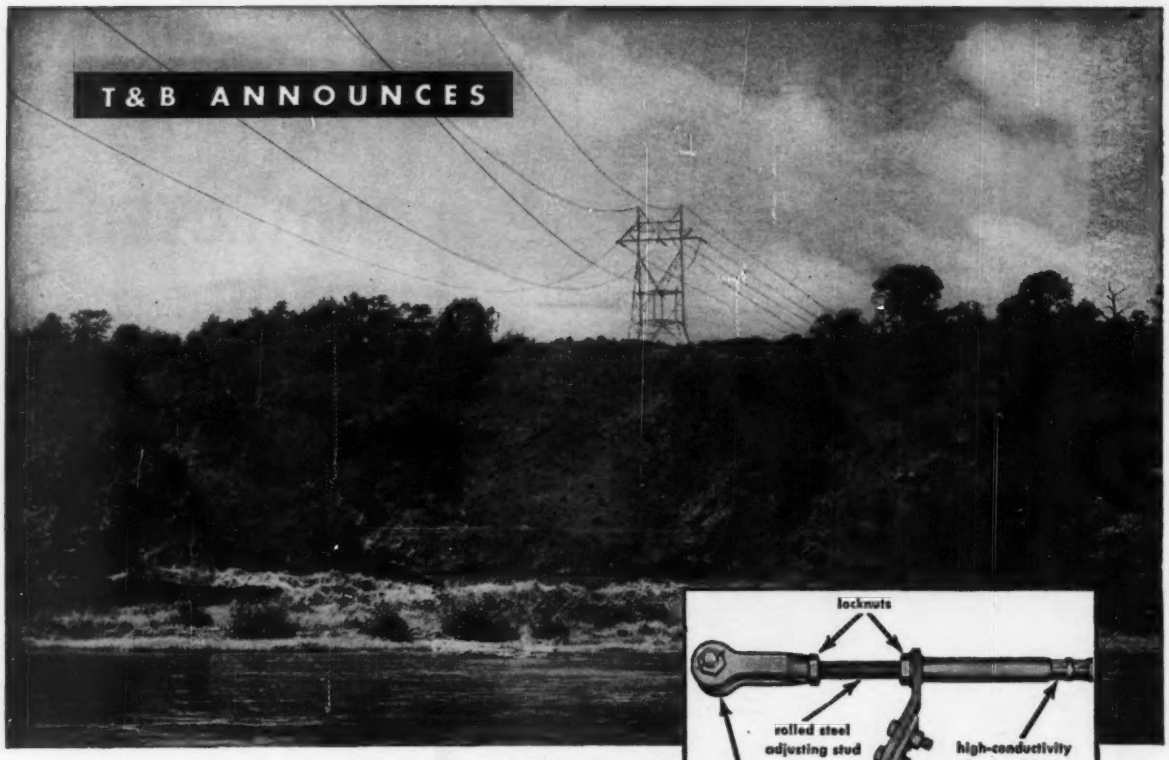
*Progress Is Our Most Important Product*

GENERAL ELECTRIC

**TOP ACCESSIBILITY**—Air passages in top section are completely accessible through nine openings. Filter installation, inspection or replacement is fast and easy.

**EFFECTIVE DIRT REMOVAL**—Ventilating system of new Weather Protected Motor prevents dirt, moisture and other contaminants from entering motor interior.

**SIMPLIFIED MAINTENANCE**—Removable, lightweight end shield permits complete accessibility to motor interior and bearings without disturbing alignment.




# a new concept in transmission dead ending!

## *DEAD END CONNECTORS PERMIT SAG CORRECTION AFTER JOINT IS COMPLETED*

Now you can adjust conductor sag to specification after the strain connection has been made! Four inches of clevis adjustment available provides great sag adjustment. For example: in a 700 foot span of 795,000 CM A.C.S.R. sagged at 50% of ultimate strength, the 4 inch clevis adjustment will allow 4 feet of sag adjustment.

The new dead end connector gives many important advantages: transmission line dead ending at river crossing and over rough terrain is simplified, more economical; "bundled" cables can be easily sagged with complete uniformity; line measurement errors can be readily compensated.

T&B Dead Ends are available for all commercial sizes of A.C.S.R. and all-aluminum conductors in three types: single bolting pad, double bolting pad, and with an integral compression loop connection.

*For complete specifications on the new dead ends, as well as the complete new catalog of T&B Method transmission line connectors, tools and accessories, send the coupon below.*

AUTHORIZED DISTRIBUTOR T&B ENGINEERED

LOOK FOR THIS SIGN — IT'S THE MARK OF AN AUTHORIZED DISTRIBUTOR

**THE THOMAS & BETTS CO.** INCORPORATED

14 BUTLER STREET, ELIZABETH 1, NEW JERSEY

Please send me the new T&B Method Bulletin 70

Name_____ Title_____

Company_____

Address_____

City_____ Zone_____ State_____

## Bundling Saves $500

(*Continued from page* 89)

tween poles, the secondary is supported by guy wires.

The new method saves about $450 to $500 in conductor, clamps, electrical connectors, and labor outlays for a 1,000-kva, 120/208-v transformer bank, in replacing the conventional strain bus and vertical taps to the transformers. It serves larger loads in shopping centers and small industrial customers with loads from 500 to 1,000 kva.

The method stems from experimentation to find an easier, more flexible, and lower-cost means of connecting up 3-phase banks rated up to 1,000 kva. Such a bank has full-load secondary currents of 2,775 amp at 120/208 v and 2,400 amp at 120/240 v. These currents present problems in connecting banks without the use of expensive bus bar arrangements, numerous large expensive clamps, and electrical connectors.

### Minimum Fittings Used

To solve such problems the company installs $\frac{5}{16}$-in. galvanized steel wire between the two poles of the structure and deadends it on single-spool racks. Lashed to these messenger wires are the multi-conductor secondaries, usually run continuously from the transformers to the customer's service entrance. A minimum of clamps and connectors is used. Lashing is done with No. 6 bare soft-drawn copper tie wire every few feet to support up to four 1,000-MCM covered copper conductors from each messenger.

The messenger support is installed only between the poles of the transformer structure and between the structure and an adjacent service pole, when the latter is required. A messenger is not used in the service drop. Instead, one conductor per phase is dead-ended at the structure and building, with other phases tied to this conductor.

Besides being more convenient and simpler, this arrangement of service drop avoids the need for insulating the messenger close to the building. The only insulation added at the building is tape over the dead-end clamps and connections of phase wires serving as messengers.

(*More How To on page* 96)


Meter Performance Protected!

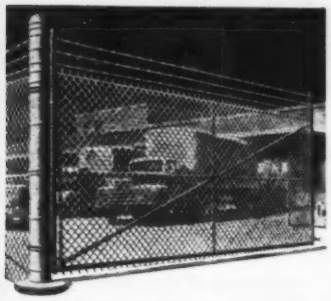
Every accurate meter deserves the protection of an S-1 Square meter Socket that's precision-built to safeguard meter performance for 30 years or more.

Ask your G-E Salesman, he'll show you proof. (628-5)

GENERAL ELECTRIC

PAGE chain link FENCE

America's First Wire Fence—since 1883



LASTS LONGER—COSTS NO MORE

It's Aluminized!

• Here's important, money-saving news *for you*. By a patented process Page is producing a *great new wire* which provides better, longer-lasting fence protection at a substantial long-range saving. Commercially pure aluminum is bonded to fence fabric wire and thus combines the strength of steel with the corrosion resistance of aluminum. ASTM salt spray tests show that for equal thickness of coating, the new aluminized wire outlasts galvanized wire by more than 2 to 1, yet with all the advantages of this *new* fence fabric it costs no more to buy and install a Page Chain Link Fence with ACCO Aluminized Fabric. In terms of years of unfailing service your investment can be halved or more. And to be sure of expert, reliable workmanship your fence will be engineered and erected by a nearby, long-experienced member of Page Fence Association. For helpful Page data...

*Write to* PAGE FENCE ASSOCIATION, *Dept.* W, *Monessen, Pa., Atlanta, Bridgeport, Chicago, Denver, Detroit, Houston, Los Angeles, New York, Philadelphia or San Francisco.*

PRODUCT OF PAGE STEEL & WIRE DIVISION OF AMERICAN CHAIN & CABLE COMPANY, INC.

**control batteries are built for**

**25 years of**

**"packaged power"**

**At Weyerhaeuser Timber Company,** switchgear control batteries in Everett, Wash., sulphite mill are C & D PlastiCal® —the batteries built for control . . . and to last 25 years.

**. . . they're C&D PLASTICAL®**

Not just "batteries"! These are *engineered* C & D PlastiCal® (lead-calcium) control batteries—batteries specifically designed for switchgear, control, and auxiliary power service —batteries built to deliver high, steady output with only minimum maintenance *for the next quarter-century!*

Weyerhaeuser Timber Co., big suppliers of woodpulp to the paper and allied industries, wanted more than just batteries. Their choice: C & D PlastiCal® —the control batteries with the "more battery for the money advantages."

**See why**

For details, send for Bulletin CP-536. Find out about the battery of tomorrow—today!

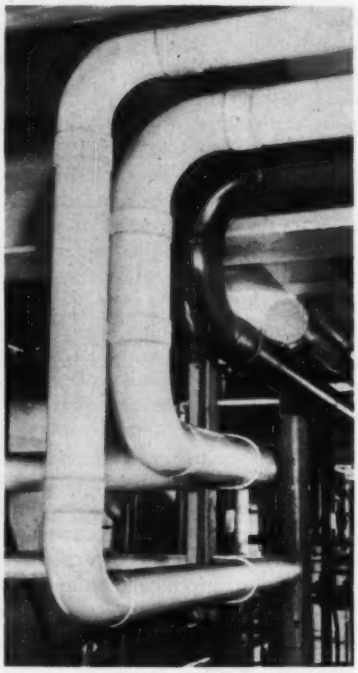
**C&D BATTERIES, INC.**

*of Conshohocken, Pa.*

Since 1906

Sales and service offices in principal cities from coast to coast



## Lightwall Stainless Steel Cuts Maintenance Costs

Lightwall stainless steel pipe in the boiler-water makeup lines resulted in a lower total installed cost at the Shawville Station of Pennsylvania Electric Co. Maintenance costs on these lines have been negligible during three years of operation.

Source of makeup water at Shawville is the Susquehanna River, which has a pH as low as 3.2. This highly acidic water contains sulphuric and sulphurous acids, plus parts of iron, nickel, and copper. Makeup averages about 0.75% of boiler steam flow, or about 50 gpm.

Corrosion-resistant piping was necessary between the demineralizer, storage tanks, and condenser to prevent contamination of the treated and purified makeup water. Initial cost of type 316 lightwall stainless compared favorably with black steel piping, and was lower than rubber-lined pipe or conventional Schedule 40 stainless pipe. In addition, installation costs of lightwall steel were lowered through use of stainless weld fittings.

Total length of lightwall stainless used in the makeup system is 600 ft. Permanent connections in the pipe and for fittings to equipment and other pipe are welded. Joints which may be disconnected are made either by expanding the pipe or welding it to insert flanges which bolt together. Welded connections and fittings keep the pipe at the same thickness throughout. Schedule 40 stainless pipe would have required threaded fittings and threaded pipe, which would reduce pipe wall thickness about 50%. This would introduce the possibility of future maintenance.

**GENERATION**—Maintenance

## Fog Applicator Finds Air Leaks in Boilers

An insecticidal fog applicator has been used successfully by Wisconsin Electric Power Co to detect leaks in power plant equipment—a tedious, time-consuming, and often futile problem.

Formerly, a torch was used to search the outer surface of boilers for leaks. The leaks were detected when the flame was disturbed, but a thorough job required coverage of the entire area.

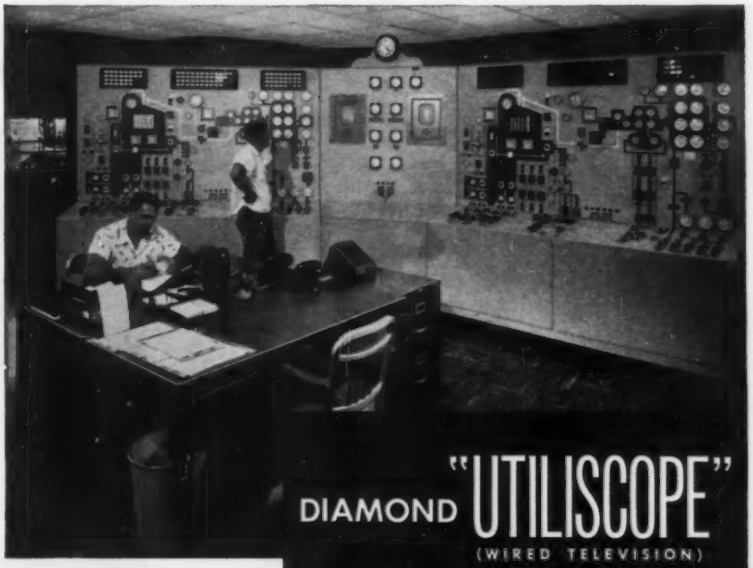
### Fill Furnace with Fog

With the fog applicator, a non-toxic non-flammable oil is substituted for the insecticide normally used in agricultural spraying. A white fog is injected into the furnace, which has been "bottled up" for the test. When the furnace is full of fog, a small pressure is applied, forcing the fog through any leaks in the boiler setting. The leaks are then marked for patching. The entire test takes less than an hour.

Although most leaks are visible to the naked eye, small leaks are found easily with "black light." This ultraviolet light causes fluorescent materials to glow, showing the slightest trace of fog around small leaks.

The fog applicator is also used to locate leaks in pulverizer mills. Air leakage tests formerly used indicated the mill condition but not the locations of the leaks.


AUTOMATION IN POWER PLANTS



DIAMOND "UTILISCOPE" (WIRED TELEVISION)
HEAVY DUTY EQUIPMENT FOR VISUAL INFORMATION

"UTILISCOPE" CAMERA

"UTILISCOPE" RECEIVER

The Diamond "Utiliscope" makes possible the ultimate in automation for power plant control. It enables the operator to see clearly anything that requires visual check. He no longer need depend upon indirect interpretations to know what is happening outside his range of vision.

The operator in the above photograph is watching the ITV image of the water level in two boilers . . . transmitted by "Utiliscope" cameras focused on Diamond Bi-Color water gauges. The water levels are easily and unmistakably read on the viewing screens. There can be no error . . . the level is shown correctly or there is no picture.

The Diamond "Utiliscope" is heavy duty equipment for power plant application. Other power plant uses are: watching flame conditions in boiler furnances, watching smoke emission from stacks, and watching remote entrances for intruders. Have you explored the "Utiliscope's" resources for saving money and improving operation? Use the coupon below for further information.

7800

DIAMOND POWER SPECIALTY CORP.
FIRST IN INDUSTRIAL TELEVISION
LANCASTER, OHIO
OFFICES IN 39 PRINCIPAL CITIES
Diamond Specialty Limited—Windsor, Ontario
Since 1903, Diamond has Manufactured Quality Equipment for Industry

DIAMOND POWER SPECIALTY CORP.
ELECTRONICS DEPT., P.O. BOX 58K
LANCASTER, OHIO

Please send me without obligation a copy of bulletin showing how Diamond Industrial (Wired) Television will help me reduce costs and improve operations.

Name_____

Title_____

Company_____

Address_____

# EFFECT SUBSTANTIAL
## USE G&W HI-LO

Looping an existing circuit through a new step-down substation being built created a problem for the Philadelphia Electric Company. The existing single conductor 69kv low pressure oil filled cables could have been cut and extended to the new substation with cables of the same type and by using commercially available joints for the purpose. However, a thorough study of the plan revealed that the use of high pressure oil filled pipe type cables for the new lines would result in substantial savings. The problem: no proven stop joint was available.

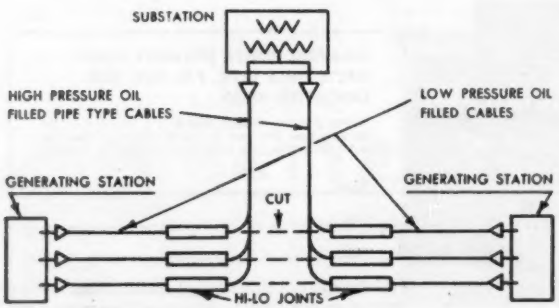
The solution was found in G&W's long experience and complete facilities for designing and manufacturing high voltage cable devices. A successful stop joint to connect 69kv low pressure oil filled cable with high pressure oil filled pipe type cable was produced by G&W collaborating with Philadelphia Electric Company and Phelps Dodge Copper Products Corporation.

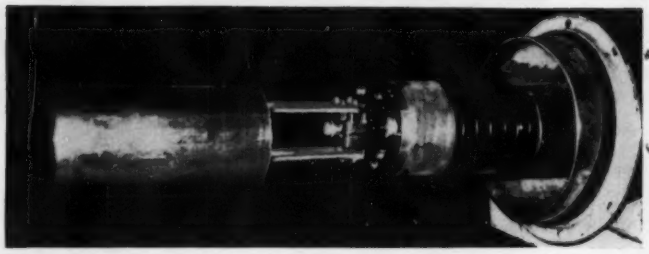
A few months after Philadelphia Electric's installation was completed a large western utility also learned that the HI-LO joint would be profitable to use in its system changes. Installation will be made early in 1958. A HI-LO joint may help reduce the cost of plans you are contemplating for the future. Review them completely. Our cooperation is assured.

TEST DATA—All mechanical and electrical tests proved satisfactory. No evidence of distress, such as carbonization or tracking, was found upon visual inspection and dissection of the joints. Electrical tests in accordance with A.I.E.E. No. 48—Standards for Potheads and High Voltage Time Test of A.E.I.C. Specifications for Pipe Type Cable were as follows:

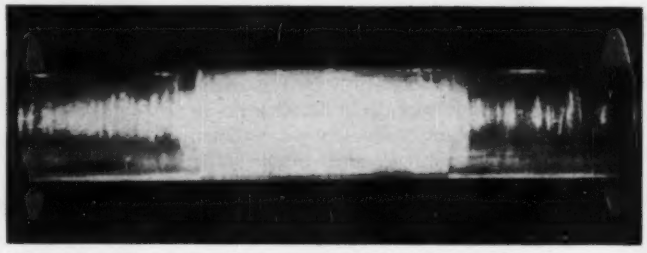
Impulse voltage withstand (350kv required)—OK
60 cycle, one minute withstand (175kv required)—OK
60 cycle, long time tests (97kv required for 6 hours)—OK

a) Withstood 123kv for 6 hours
b) Withstood 148kv for 6 hours
c) Withstood 172kv for 26 minutes—pipe type cable failed outside of joint

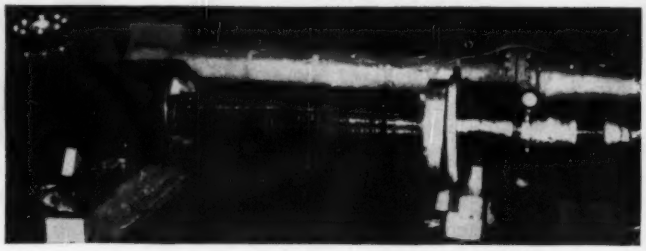


Terminal connectors of the opposing pothead ends are joined by copper straps. This central section is enclosed with a copper sleeve shield which constitutes the high voltage electrode.

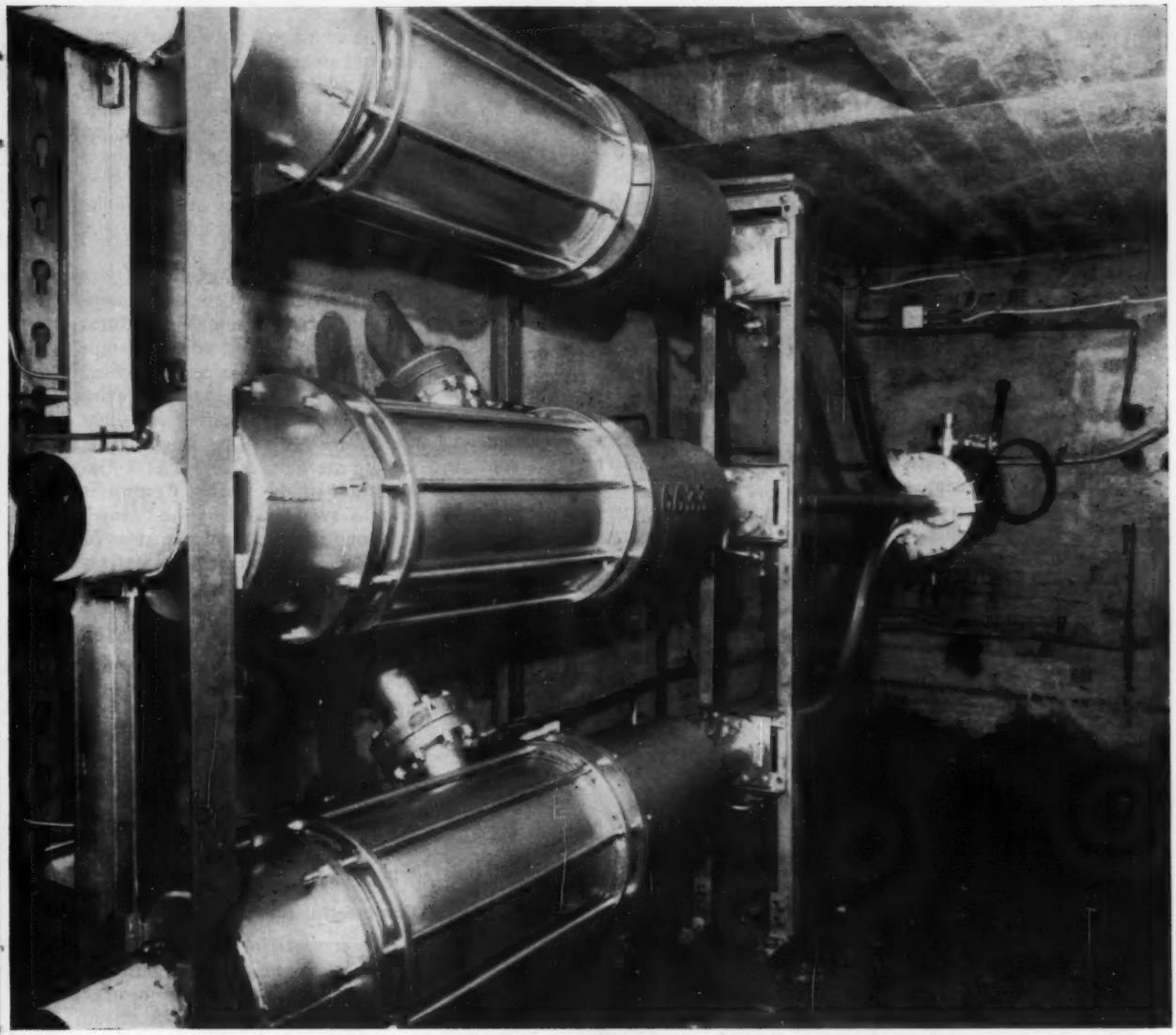


Lucite tubes fit in ends of the copper shield and extend over paper insulated lengths of pothead porcelains. Oil passage to the shield cavity is provided by Tygon tubing spirally wound between crepe paper insulation and Lucite tubes.



Additional crepe paper is applied to a uniform diameter over the Lucite-copper-Lucite assembly for overall joint insulation. Casing may be sealed by welding or by couplings.

# SAVINGS · · · · ·
# PRESSURE STOP JOINTS



Each joint consists essentially of two potheads enclosed in an oil filled non-magnetic steel casing.

**G & W ELECTRIC SPECIALTY COMPANY**

**3500 WEST 127TH STREET · BLUE ISLAND · ILLINOIS**

G&W

ATJ581

# Flexible Auditorium Handles Many Functions

## Duke Power's new facility rivals Broadway theaters, has built-in flexibility, and a 65-kw commercial kitchen besides

**W. J. WORTMAN,** Asst to the Manager of Operations, Duke Power Co, Charlotte, N. C.

A modern auditorium and electric center which is equipped to handle several different types of functions has been added to the Duke Power Co's general office building.

Flexibility was stressed during the design and layout of the center. Almost 7 months were required to incorporate all the ideas of the supervisors. The center has been labeled as the best such utility facility by an appliance manufacturer's salesman who travels the country putting on programs. The only thing lacking is a loft above the stage to make it as flexible as a Broadway theater.

The main element is the auditorium which will seat 175 people comfortably in aluminum arm chairs. In a "leg" off of the hall is a complete commercial kitchen which can be separated from the auditorium by a folding wall. Another divides the auditorium into two rooms.

General illumination is provided by recessed incandescent-lamp fixtures. There are connected by multiple circuits, for each half of the auditorium. Lights in each half can be switched by wall controls, or both areas can be controlled simultaneously from a panel on the stage. All lights can be dimmed.

Swivel lights are mounted in the ceiling a few feet out from one wall of the auditorium. These lamps "spot" appliances or equipment during exhibitions. Controls for the spots are back stage.

The sound system of four speakers and an amplifier is located backstage. Microphones can be plugged into two floor outlets on the stage and at three other locations in the auditorium where electrical outlets are provided for a projector operation Four projectors are available: 16 mm movie, viewgraph, film strip, and slide.

The stage is fully equipped with lights, appliance outlets, and plumbing connections. Adjustable fixtures containing clear and colored lamps are mounted on the ceiling behind the valance. Similar lamps are installed in a disappearing foot-light unit at the front of the stage. In the ceiling are fixtures for general illumination of the stage. Control is from a switchboard in the "wing."

Along the back and two sides of the stage are troughs having removable covers. Troughs contain plumbing connections and electrical outlets, so that appliances can be operated in different kitchen layouts.

Instead of a loft, four channels are secured to the ceiling, running from front to rear, for suspending drops or a movie projection screen.

Several portable tack boards are available in the auditorium. Use of these boards obviates the pinning of displays to drops and curtains or taping of posters to walls.

### Commercial Kitchen Serves 96

The commercial kitchen contains 65 kw of cooking equipment. In addition to promotional demonstrations, the equipment is used for preparing meals for different gatherings. Food is served in the snack bar next to the auditorium and seats 96. This keeps the auditorium tidier.

The auditorium is air conditioned year round. Fresh air is continually pumped in and heated or cooled. Stale air is dumped outside. To eliminate cooking odors, air is not recirculated.

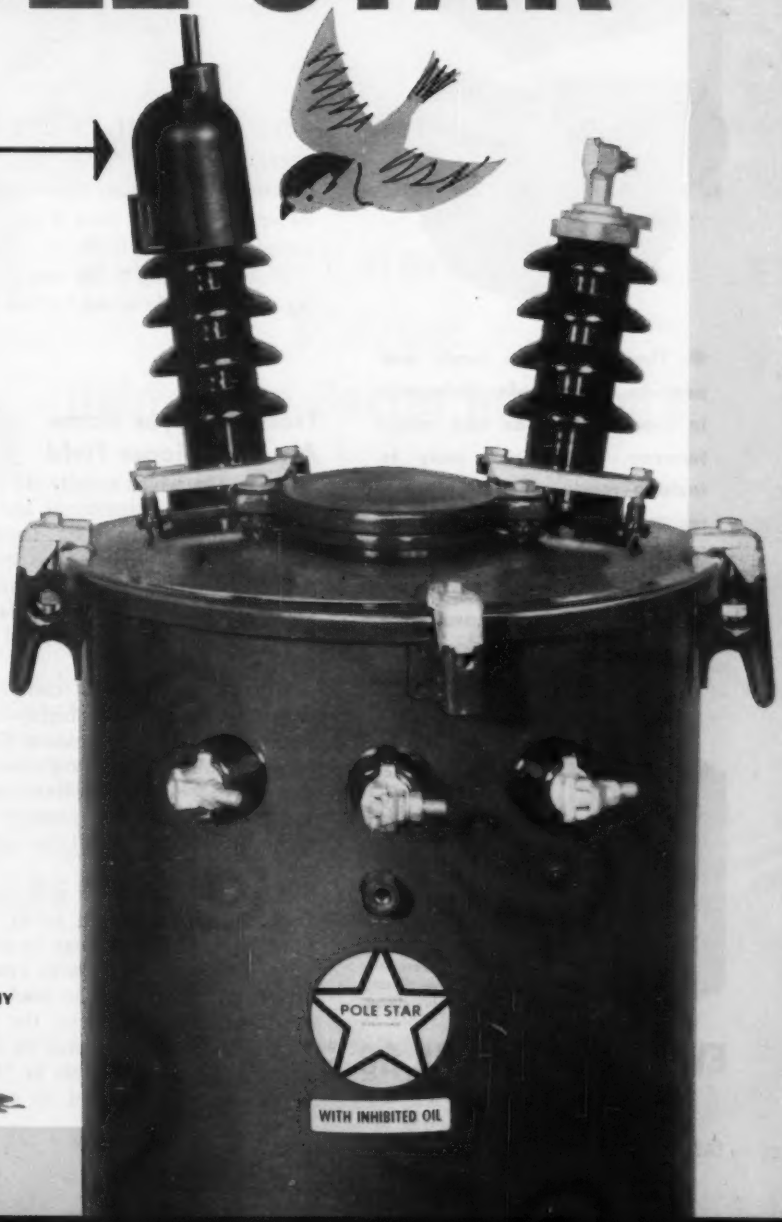
**65-KW COMMERCIAL KITCHEN is another feature of new Duke Power Co auditorium. Used in connection with meetings, it serves snack bar in 'wing'**

(*More Selling on page* 102)

# Wildlife a problem in your area?

# POLE STAR®

offers an optional neoprene cap that slips easily over high voltage cover bushings. It protects your Pole Star transformer...and wildlife...without affecting the long-proved reliability of Pole Star's standard bushing




McGRAW EDISON

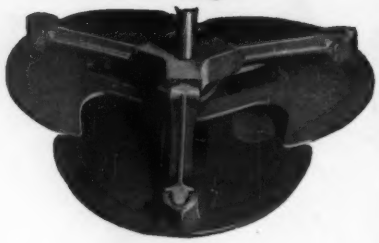
**Pennsylvania Transformer Division** McGRAW-EDISON COMPANY

CANONSBURG, PA. Greater Pittsburgh District

The Old Reliable

EVERSTICK ANCHORS...

EXTRA Holding Power
QUICKLY Installed
TOUGH For long life



● They speed up work and provide dependable anchorage in new construction and maintenance. Quick and easy to install—made of tough rust-resistant malleable iron—their holding power "tops" all other. Available two-way, three-way, four-way, and cone types. Write for facts.

AN EXCLUSIVE
EVERSTICK
FEATURE
Exclusive Everstick nut housing Locks anchor firmly on rod. No chance of rod slipping thru anchor.

EVERSTICK ANCHOR CO
FAIRFIELD, IOWA

# Selling

HEATING & COOLING ELECTRICALLY

## The Accent is on Heat Pump

The accent will be on "heat" with this heat pump being delivered to Gravois' Pharmacy in New Orleans during the first snow storm there in 59 years. The last time it snowed in the Mardi Gras city was Lincoln's birthday, Feb. 12, 1899.

Shown pointing to the unit is Charles Gamble, president, General Heating & Air Conditioning Co, as L. Gravois looks on.

### Trane Co Eyes Home Air Conditioner Field

Trane Co, which usually sticks to "custom-built" commercial and industrial air conditioning installations, is planning to enter the central residential field. A $1½ million plant being constructed near Clarksville, Tenn., will be completed this spring.

Commenting on the company's reason for entering this highly-competitive field, Trane president, D. C. Minard, said, "When you consider that only 2% of 35 million single family homes in this country are centrally air-conditioned the opportunities are obvious."

The Clarksville plant will manufacture residential units solely, but other related products may be added later. This new move marks Trane's second venture into the packaged air conditioning business; the first was an increased emphasis on self-contained air conditioners in 1956.

Industry-wide sales of air conditioning equipment in 1958 will probably continue at current sales levels with the possibility of a slight increase, according to Minard.

He sees three factors affecting the market:

- New building construction.
- The trend to air conditioning existing buildings.
- The influence of weather.

Taking into account these three points, Minard said, "Industrywide air conditioning sales are likely to hold current levels with the possibility of a moderate increase."

### A. C. Sales Up In N. Y.

Central residential air conditioning sales in the New York multiple market this year will be 20% higher than in 1957, according to H. N. McMenimen Jr, sales manager for the General Electric Air Conditioning Division.

(*More Selling on p* 104)

The technician at the control panel of Victor's Impulse generator shown above, is photographing steep front wave forms for detailed laboratory study.

# Steep Front Wave Tests at *VICTOR* Help Make Better Insulators

**By David E. Alexander, Chief Engineer**
**Victor Insulators Division, I-T-E Circuit Breaker Co.**

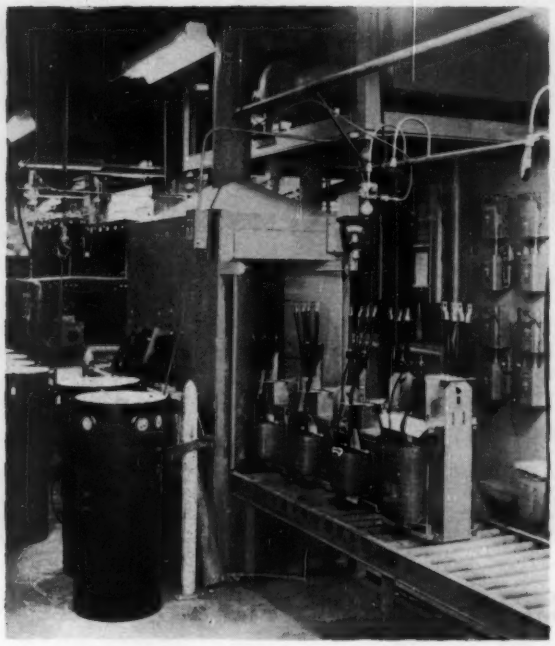
"The high voltage impulse generator in the Victor electrical laboratory enables us to simulate the most severe conditions of service an insulator will ever experience in use. By photographing the various wave forms caused by high voltage discharges, we are able to study in detail and at length, their many characteristics and their effects on insulator design and construction.

For some time now, we have been delving into the little known realm of steep front wave forms. This research has already resulted in better, stronger high voltage insulators . . . points the way to even better insulators as our studies continue."

*This is but one phase of Victor's broad continuous program of research in electricity, ceramics and manufacturing methods . . . a program that bolsters our contention that "you can't buy better insulators at any price!"*

I-T-E CIRCUIT BREAKER COMPANY
**VICTOR INSULATORS DIVISION**
Victor, New York

# Electric Oven Ends High Power Factor Rejects



**Oven dries condensed** moisture on assemblies without fire hazard. Heated units stay above room temperature for 2 hr.

Two electrically heated ovens used to dry condensed surface moisture on transformer core-coil assemblies put an end to high power factor rejects at the Kuhlman Electric Co, Birmingham, Mich. Because of their compactness, the ovens could be fitted directly into the production lines despite the limited floor space available.

In addition to providing simple, accurate temperature control, they have lower first cost and less maintenance than a gas-fired oven. Since the ovens were installed, two years ago, there has not been a single high power factor reject.

In addition to evaporating moisture that is already present, the heat put into the assemblies must be sufficient to hold them above room temperature for at least two hours, until they are covered with oil. One unit serves the small transformer line; a second, the medium line. Each uses 40-kva forced air duct heaters, operated at 230 v. Two ½-hp pressure blowers supply fresh air from outside; two 1.5-hp blowers exhaust the moisture-laden air.

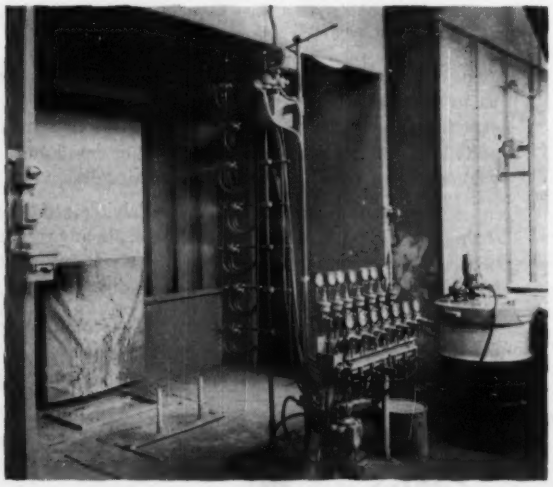
With only five ft of floor space available, the only alternative was an indirect, gas-fired unit installed on a suspended mezzanine. Because the roof above the mezzanine was wooden, the gas-fired unit was not considered to be as safe as the electrically heated ovens would be.

# Electrostatic Paint Spray Trims Labor, Material Costs

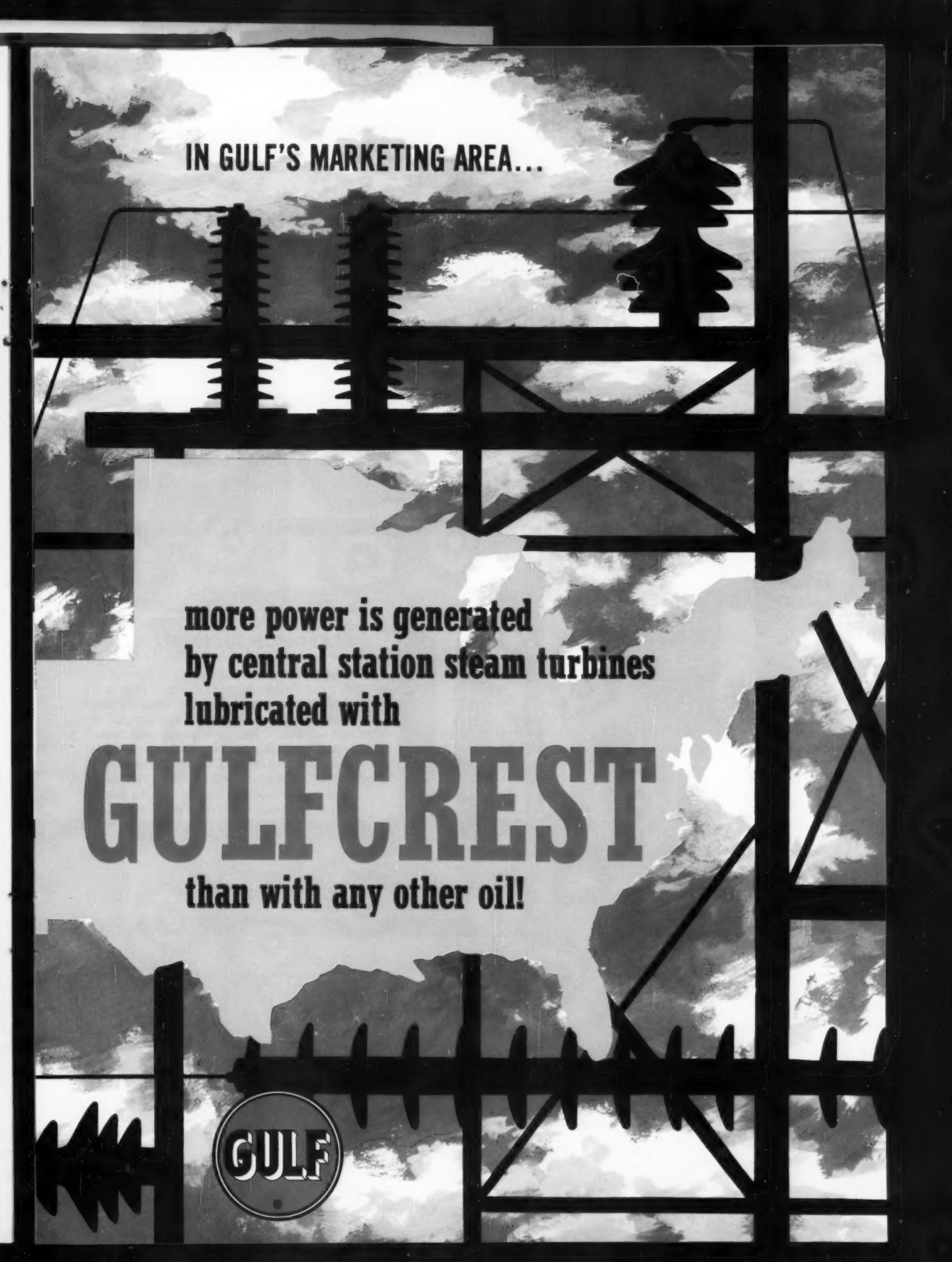
**V. J. SMITH,** Power Sales Engineer, Pennsylvania Power & Light Co, Pottsville, Pa.

More uniform coating, a better finish, and savings in material and labor are some of the big advantages of the electro-static spray-painting equipment recently installed at the Aetna Steel Products Corp, Pottsville, Pa. Used to paint flat metal insulated panels for offices and banks, the equipment improves bonding of paint to metal, requires less space, and is healthier than the manual spraying method previously used. Manpower can now be used to clean the metal panels prior to spraying.

The installation is a 5-amp, 115-v unit, which serves both sides of the panel. Panels are fed through at a 12 ft per minute rate. An electric eye activates the spray while the panel is passing through. To maintain a clean, healthy atmosphere for the employees, two 2-hp fans remove the fumes and excess paint from the area.



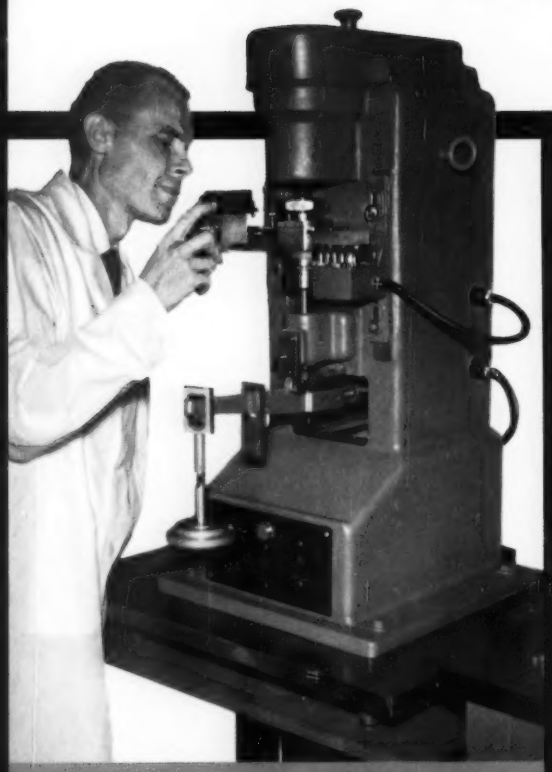
The hand spraying method formerly used often required up to 13 passes per side. Paint in some areas was denser than in others, giving the panel a spotty look. Aetna is well pleased with the results to date and expects more improvements as they become more familiar with the equipment.


IN GULF'S MARKETING AREA...
more power is generated
by central station steam turbines
lubricated with
GULFCREST
than with any other oil!
GULF

# Why leading utilities specify

Performance records—over a period of many years—*prove* that Gulfcrest Oil provides superior resistance to oxidation, and more effective protection against corrosion and wear. Its unmatched performance results not only from extra refining, but also from the use of more effective additives.

## Demonstrations like these show GULFCREST's superiority:



### STEEL ROD TEST ASTM D-665-54 SHOWS CORROSION RESISTANCE

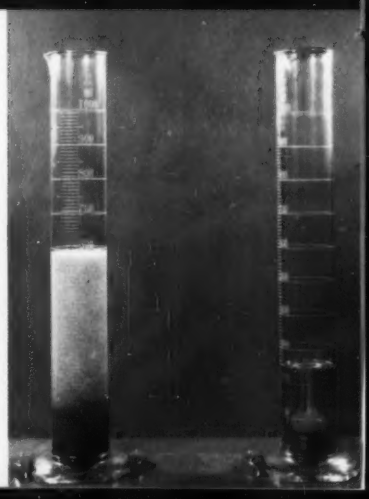
A mixture of oil and water is heated to 140°F. Polished carbon steel rods are immersed, rotated for 24 hours. Rod protected by Gulfcrest is still bright at end of test . . . positive proof that Gulfcrest's special additives impart effective corrosion resistance. There are several corrosion inhibitors in Gulfcrest which prevent costly rusting in your turbine lubricating systems. Each does a different job —"quick platers" for immediate protection, "slow platers" for reserve protection.

### 4-BALL TEST DEMONSTRATES ANTI-WEAR CHARACTERISTICS

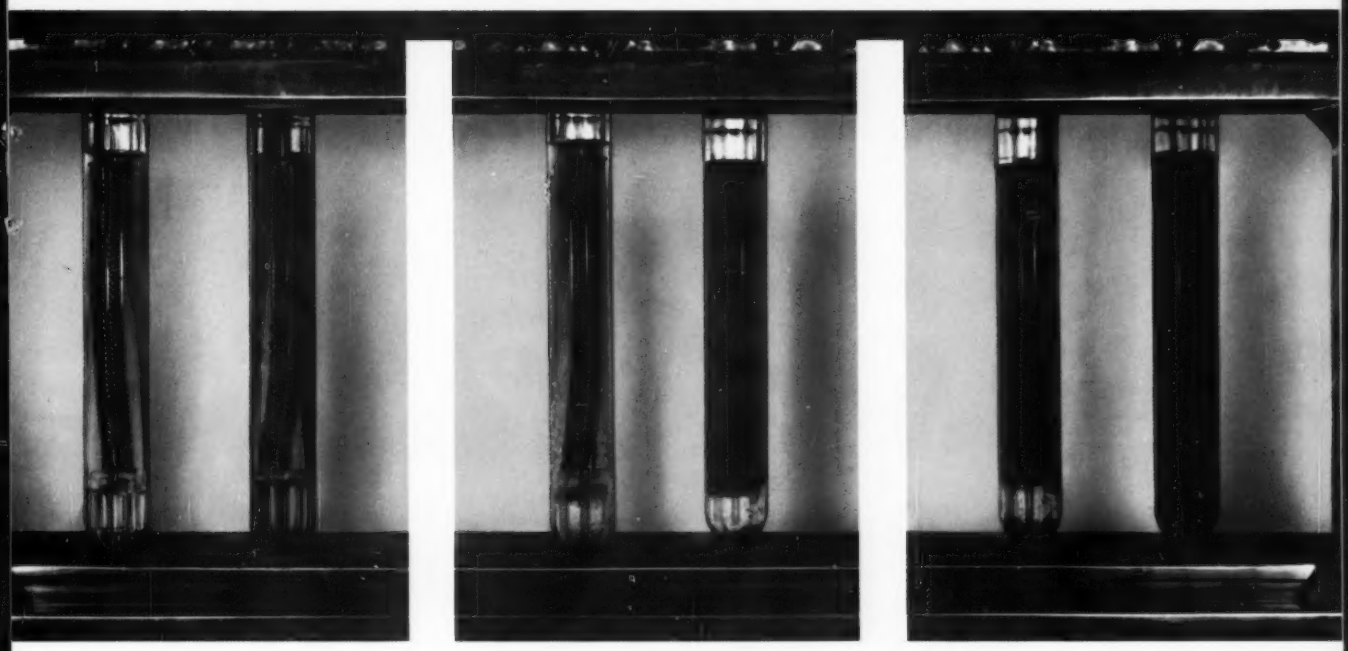
Gulfcrest has superior anti-wear properties —especially important during moments when turbines are started or stopped. Tests such as these conducted on the 4-ball wear tester machine at Gulf Research Laboratories show that Gulfcrest provides an extra margin of protection under boundary lubrication conditions.

### AIR BUBBLE TEST SHOWS NON-FOAMING PROPERTIES

In this test air is blown into the Gulfcrest sample (right), and ordinary turbine oil (left). Result: *no foam in Gulfcrest!* Gulfcrest is inhibited by a most effective silicone additive which prevents objectionable foaming in your lubricating system.



# GULFCREST TURBINE OIL



## OXIDATION TEST ASTM D-943-54 PROVES GULFCREST'S STABILITY!

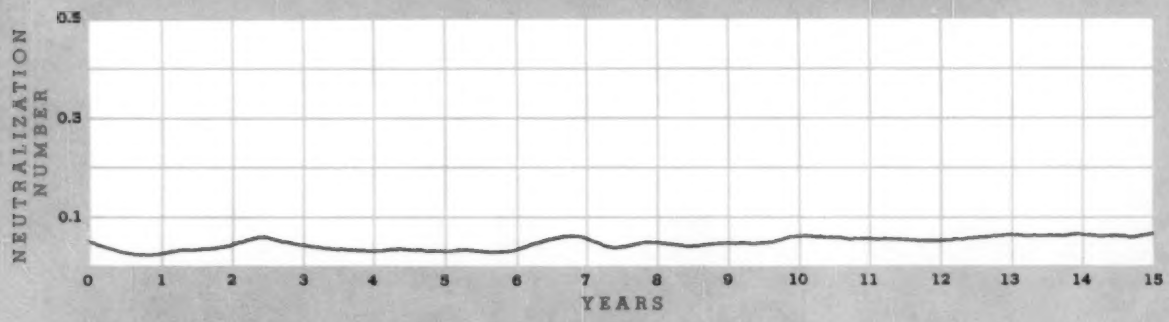
This test dramatically demonstrates the difference between Gulfcrest and ordinary turbine oils. Iron and copper coils are immersed in oil and water heated to 203°F. Oxygen is bubbled through. Photo No. 1 (above, left) shows Gulfcrest in test tube at left, top grade competitive turbine oil at right, at start of test. Photo No. 2 shows samples after 250 hours. Note how Gulfcrest Turbine Oil retains its golden color, while the competitive oil has turned dark, indicating hydrocarbon deterioration. Photo No. 3 (above, right) shows Gulfcrest and competitive turbine oil at conclusion of 2,000 hour test. Gulfcrest's oxidation stability is your assurance of long life and a clean turbine lubricating system.

## 20-DAY LIGHT TEST SHOWS RESISTANCE TO DARKENING

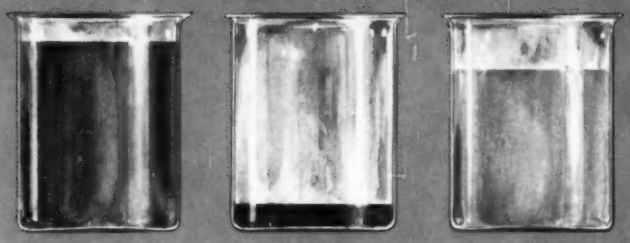
At the beginning of this test, both Gulfcrest and the ordinary turbine oil beside it are clear in color. After 20 days of exposure to light, only Gulfcrest remains clear. The other oil has darkened, and has a precipitate on the bottom. The special inhibitor which prevents oxidation in Gulfcrest also helps to maintain the clear color—a big help in detecting the presence of fly ash or other contaminants. This is an advantage that Gulfcrest has over many other turbine oils that use antioxidants which contribute to rapid darkening of the lubricant in service . . . and the possible formation of insoluble sludges.

GULF

# GULFCREST 15-year performance record in 150,000 kw unit




**Note remarkably low neutralization number after 15 years of service.**



## GULFCREST is Alchlor-Processed!

The Alchlor Process—an exclusive *extra* refining step—weeds out unstable hydrocarbons which are present after normal refining.

This extra step discards about 15% of the oil . . . removes harmful elements which could oxidize, form sludge, acids, emulsifiers . . . provides a super-refined, stable fraction with greater ability to benefit from suitable additives.

Alchlor-Processed Gulfcrest lasts longer, gives superior lubricating performance, helps to keep turbine systems clean indefinitely.

## GULFCREST provides safe, sure protection!

Many prominent power companies use Gulfcrest exclusively. Gulfcrest performance records are unmatched. There are cases on record where Gulfcrest has served large turbines continuously for 15 to 20 years—keeping the systems free from sludge and rust, and neutralization numbers consistently low. In Gulf's marketing area, more power is generated by central station steam turbines lubricated with Gulfcrest than with any other oil.

***Mail this coupon today for free 8-page fact-filled booklet on GULFCREST!***

**GULF OIL CORPORATION**
Dept. DM, Gulf Building, Pittsburgh 30, Pa.

Please send me illustrated booklet on Gulfcrest.

Name_____

Title_____

Company_____

Address_____

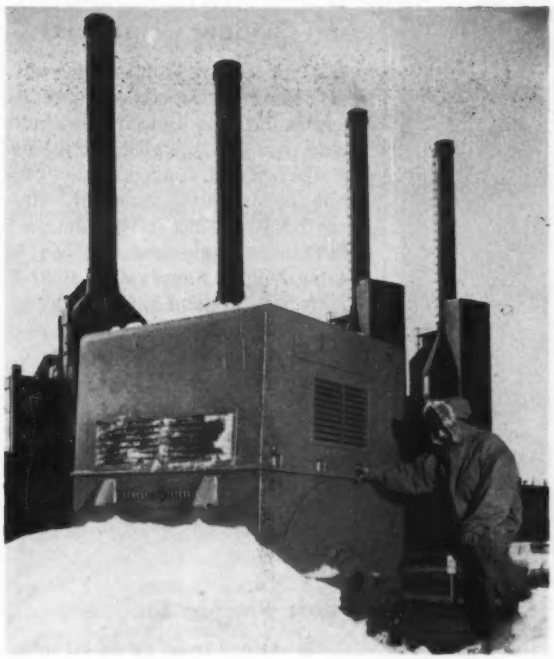
City_____ Zone_____ State_____

GULF

**The finest petroleum products for all your needs**

SP-9241

# New Equipment

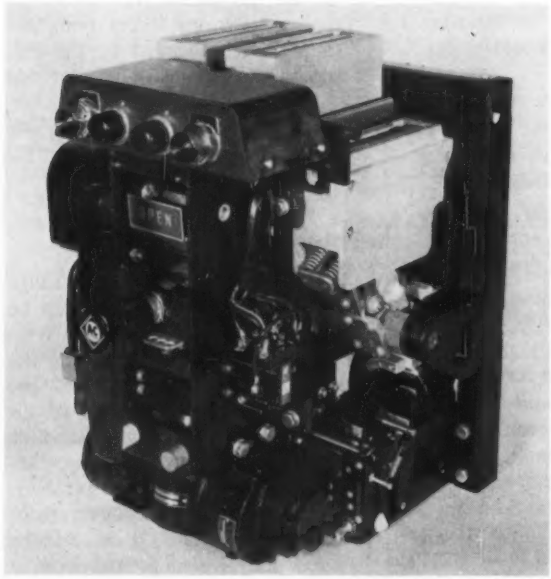


## Outdoor Motor . . .

**. . . in ratings of 250 hp and up** occupies up to 33% less floor space than previous models. Frame has no vents; all air enters through louvers in top section. Motors may be mounted side by side without interfering with ventilation. Provision for straight blow-through for high winds prevents damaging pressure build-ups. Bearings can be removed without disturbing alignment. Filters are easily accessible through end of top section to simplify maintenance. End shield design permits 300-deg inspection of windings.
**General Electric Co, Schenectady 5, N. Y.**

## Quick-Break Device . . .

**. . . for horizontal and vertical break switches** rated 600 amp at 7.5, 15, 23, 34.5, 46, or 69kv, reduces arcing hazards and prevents phase-to-phase faults. Snap action of quick break-rod, at predetermined position of switch blade, interrupts current rapidly and safely. Speed of rod tip is independent of switch opening speed. Other features are simple field installation, controlled rod action after interruption, and isolation of beryllium-copper rod from current path when switch is closed.
**Line Material Industries, Milwaukee 1, Wis.**



## Low Voltage Air Breakers . . .

**. . . with hydraulic closing mechanism** are available in 225 and 600-amp ratings. Hydraulic operator permits closing directly from a-c power source with low control power requirements. Smooth, quiet action reduces stress on operator and contact components. Completely sealed unit needs no adjustment and little maintenance.

Continuous current coils are easily replaced, through rear access ports, without disturbing trip unit. Dual magnetic, selective and thermal trip devices for 225, 600, and 1,600-amp units are all interchangeable. Removable steel front provides "dead-front" unit and simplifies access to components.
**Allis-Chalmers Mfg Co, Milwaukee 1, Wis.**

(*More New Equipment on page* 110)

Westinghouse APT

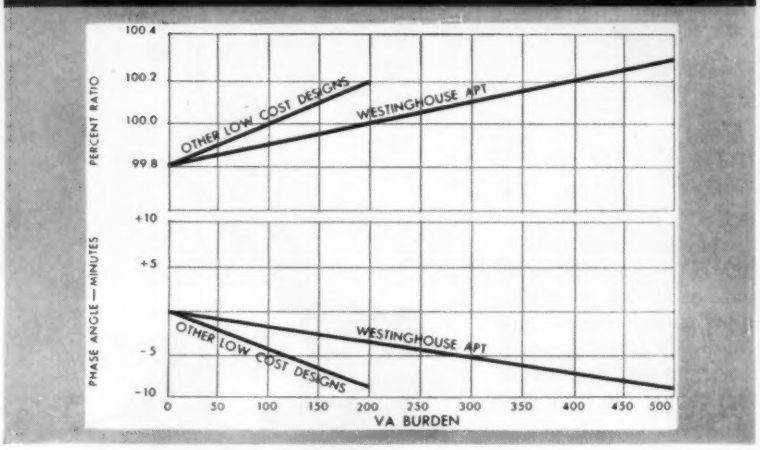
potential transformer . . .

92 through 230 KV . . .

50% MORE

THERMAL CAPACITY . . .

GREATER ACCURACY




Westinghouse APT transformers meet ASA 0.3 accuracy standards through 500 volt-amperes burden at the price you'd pay for a competitive unit with 0.3 accuracy through only 200 va . . . Here's extra capacity for future load growth —without extra cost.

Thermal rating . . . 6500-va minimum for 115-kv APT compares with only 4000 va for other low-cost designs.

The Westinghouse APT is not a cascade design. It is a modification of conventional Westinghouse OPT designs, utilizing a solid insulation principle made possible by advanced knowledge of insulation application. Result: an equivalent-priced but less complex (single core and coil) design than the cascade-type construction.

Single-piece porcelain and welded tank construction reduces possibilities of gasket leaks.

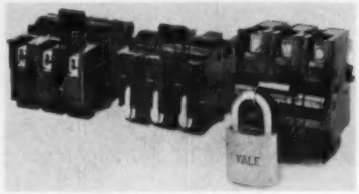
Call your Westinghouse representative for the full performance story on the APT transformer—another example of Westinghouse leadership in transformer design, made possible by Plowback of Earnings into research and development.

J-70866

YOU CAN BE SURE...IF IT'S Westinghouse

## Anti-Oxidant Compound . . .

**. . . for electrical joints** removes oxide film from copper or aluminum without harming base metal. Joints made with it have resistance as low as silver-plated connections. Compound is insoluble in water. Bulletin HV10-35 has further data. **Hi-Voltage Equipment Co, Div of Joslyn Mfg & Supply Co, 4000 E 116th St, Cleveland 5, Ohio**




## 3-Pole Plug-In Breakers . . .

**. . . in ratings from 15 to 70 amp,** 240 v, are an extension of Stablok series. Designed as main disconnects for standard lighting, power and combination panelboards, both 3-phase 3-wire and 3-phase 4-wire, they can also be used for 3-phase motor circuits and other machine applications.

Ratings of 15 to 40 amp are available for 3-phase 4-wire delta systems with a 3-phase motor circuit. These units can be used to provide 3-phase motor loads in standard dual rated 1-phase lighting and appliance panels. They can also serve as 1-phase disconnects and overload protection on 240-v 1-phase applications where both live legs and neutral must be opened. Snap-in locking device is provided to lock unit in On or Off position. **Federal Pacific Electric Co, 50 Paris St, Newark 1, N. J.**

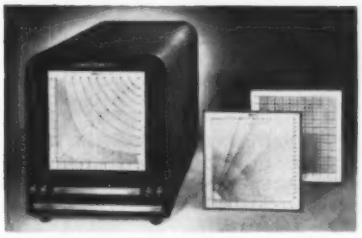
## Thermal Insulation . . .

**. . . handles temperature in range of −400 to +2,000 F,** and can be used for both single and dual temperature applications. Utilizing the same reflective principle as the Thermos bottle, it consists of air spaces partitioned by reflective metal sheets. Known as Mirror Insulation, it is available in prefabricated units for pipes, fittings, vessels, boiler casings and ducts. Using welded and riveted construction, it

is readily cleaned, easy to remove or replace, and unaffected by vibration or thermal shock.
**Mirror Insulation Co, 201 S. Main St, Lambertville, N. J.**

## Photocopy Machine . . .

**. . . makes exact copies from books,** magazines, or other bound material in 30 seconds without damaging originals. Used face down, it has plastic air cushion which follows page contours to prevent distortion. Any printed or written material, including crayon, colored inks, or spirit duplicator may be copied with the Contoura-Portable. Transparencies for Diazo machines or negative plates for offset printing may also be produced.
**F. G. Ludwig, Inc, Dept C-P, 105 Coulter St, Old Saybrook, Conn.**



## Computing Indicator . . .

**. . . plots and indicates three quantities,** two as independent, directly measured variables, the third as a derived quantity. Two d-c reflecting galvanometers and associated optical systems project horizonal and vertical light lines on ground glass screen. Lines move vertically and horizontally, respectively, in proportion to galvanometer currents. Screen also contains family of curves representing third quantity. Curves may be any mathematical or empirical quantity. Alternate screens show ratio of two quantities or other relationships.
**Aero Electronics Co, 1512 N. Wells St, Chicago 10, Ill.**

## Reactor-Booster . . .

**. . . provides sinusoidal waveform** for relay testing and increases capacity of test instruments. The impedance added by the Model 1010/RB suppresses the third harmonic introduced by the relay under test. Curves established are identical with those of the relay manufacturer. This portable unit can be quickly connected to any existing transformer load or testing device. Data Sheet 1010/RB.
**Multi-Amp Corp, 465 Lehigh Ave. Union, N. J.**

## Explosion-Proof Fixture . . .

**. . . for mercury vapor lamps** has increased lamp life and provides more lumens per watt. Designated Type EVA, it is particularly suited for high bay use. Fixture takes 250-w Type BT-28 lamp for Class I Groups C and D or 400-w Type BT-37 for Group D. Standard 300- to 500-w size EV reflectors are used.
**Crouse-Hinds Co, Wolf & Seventh N. St, Syracuse, N. Y.**

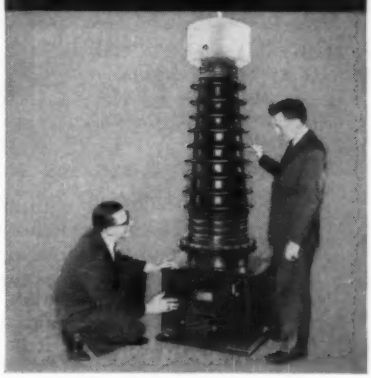
## *More New Products*

**Silicon power rectifiers** with 30-1500-amp ratings have ranges from 5½ to 135-v dc. Regulation is ±0.5%; response, 0.1; ripple, 1% rms—Christie Electric Corp, 3410 W. 67th St, Los Angeles 43, Calif.

**Temperature monitor** for −400 to +3000F range has 5-amp load relay. Unit is complete control unit, ready to connect to thermocouples and 115/230-v power source. D-c models available.—Assembly Products, Inc, Palm Springs, California.


Westinghouse
type APT
potential
transformer

SAVES 40% ORIGINAL COST OVER CONVENTIONAL DESIGNS



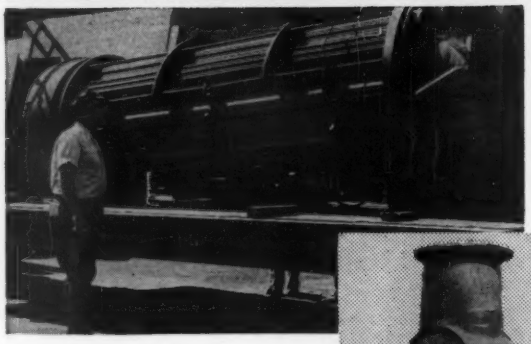
The Westinghouse Type APT potential transformer is designed for low-cost positive protection and greatest metering accuracy. Its design—single-core-and-coil and single-bushing—provides a saving in original cost over conventional design units . . . without sacrificing either accuracy or protection.

The APT meets all ASA standards for high-voltage metering and relaying applications . . . it's the Westinghouse answer to your demands for *high* accuracy at a *low* cost.

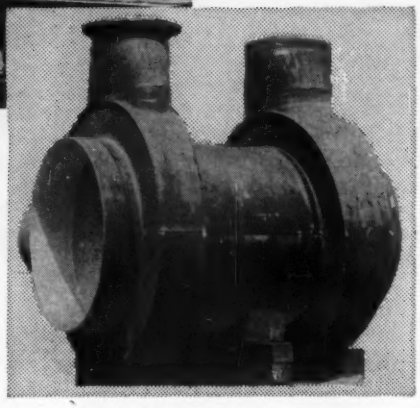
J-70865

YOU CAN BE SURE...IF IT'S
Westinghouse

# JUST TWO MORE EXAMPLES OF CONSECO SERVICE



**FOR TUBULAR EQUIPMENT**



**1** ABOVE—*A high pressure heater for feedwater, retubed by CONSECO and on its way back to PHILADELPHIA GAS & ELECTRIC.*

**2** RIGHT — *Special CONSECO Heat Exchanger, aluminum sprayed interior, and calorized tubes. FOR GENERAL CHEMICAL COMPANY.*

CONSECO is equipped and thoroughly qualified by over 30 years experience to repair, re-tube, re-design or re-build any type of tubular equipment, our own or of any other manufacture. Extensive facilities and personnel handle emergency assignments on the job or in our own shops. A CONSECO re-designed unit is usually a better product than the original equipment because it benefits, during repairs, from our familiarity with all types of tubular equipment and of features that help to achieve longer, trouble-free, more efficient operation.

Full maintenance and spare parts service available. Emergency Service at any hour, day, night, all holidays; anywhere on the continent. Just call our Maintenance Department.

***Any day — any night — 24 hours every day . . .***
***Conseco Service is as near as your telephone —***

**CONDENSER SERVICE & ENGINEERING CO., INC.**

**Designers and Builders of Equipment for Power, Refining, Chemical and Marine Industries**

**163 OBSERVER HIGHWAY**
**HOBOKEN, N. J.**

**Phone: OLdfield 9-4425 • N. Y. Tel: BArclay 7-0600**

***SEND FOR THIS STEAM CONDENSER BULLETIN*** ➡
*For more data consult Chemical Engineering Catalog pages 559-562*

**CONSECO DESIGNS AND BUILDS**
HEAT EXCHANGERS • CONDENSERS • EVAPORATORS • STEAM JET AIR EJECTORS • PRESSURE VESSELS • FEED WATER HEATERS • SEWAGE EJECTORS • CONDENSATE COOLERS • ENGINE PARTS • SERVICE WATER COOLERS • FILTERS and STRAINERS • INSTRUMENTS • SPECIALTY ITEMS

*COMPLETE BULLETINS SENT ON REQUEST*


## NEW LITERATURE

• **MISCELLANEOUS:** Following bulletins are published by General Electric Co, Schenectady 5, N. Y.

**Application Data for Numerical Positioning Control** (14 pp) describes functions of numerical control, gives a detailed breakdown of data input, director and series drive elements, and provides data on applications. (GET-2676)

**Outdoor Stations** (20 pp) discusses integrated stations, from plans to installation. (GEA-5573B)

**Pyrometers** (8 pp) explains features of a complete line with emphasis on printed circuits, lead length compensation and flexibility. (GEA-6650)

**Soldering Irons** (8 pp) explains features of irons including light weight, calorized and iron clad tips and tubular heater. Includes case histories of savings obtained by users. (GED-3553)

**Semiconductor Power Rectifiers** (12 pp) discusses silicone and germanium power rectifiers for use in electrochemical processes, aluminum and copper production, electroplating, anodizing and steel process lines. (GEA-6375A)

• **SILICONE OIL:** 4-p data sheet, SF-1103, describes specifications and physical properties of electrical grade silicone oil. Silicones Div, Union Carbide Corp, 30 E. 42nd St, New York 17, N. Y.

• **OVERHEAD LINE CONNECTIONS:** 100-p manual, OH-57, covers connection techniques, connectors and installation tooling. Burndy Corp, Norwalk, Conn.

• **MOTOR CONTROLS:** Catalog 5800 of 56 pp has tables giving horsepower, motor speed, heater size and ampere ratings, plus design data and stocking information. Furnas Electric Co, Batavia, Ill.

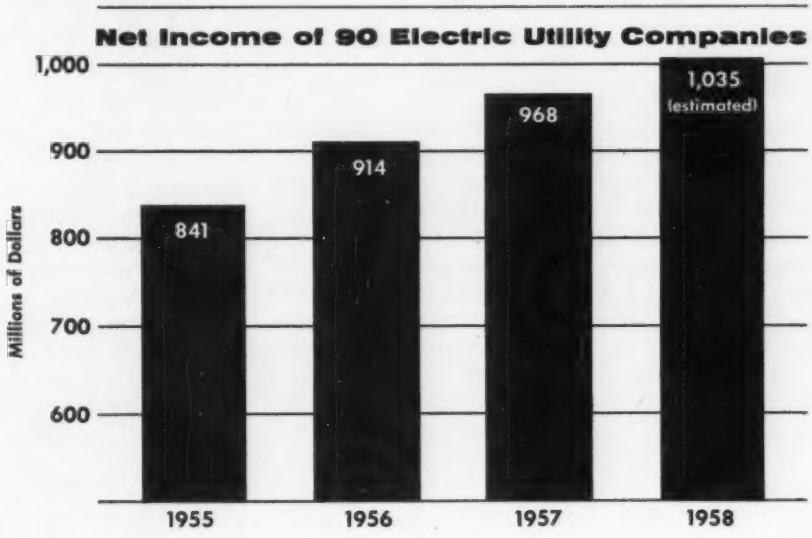
• **VIBRATION:** A 4-p bulletin, K3B, gives data on stopping vibration, shock and noise transmission by using steel spring machinery mountings. Another bulletin, VC-501, discusses the use of a vibration shock and noise controlling cork material for massive, difficult-to-isolate, machinery. Korfund Co, 48-15 32nd Place, Long Island City, N. Y.

• **SUBSTATION STRUCTURES:** An 11-p manual, 57107, describes method of erecting standardized substation structures. Line Material Industries, Milwaukee 1, Wisconsin.

• **MOTORS:** Features and design extras of squirrel cage 1-40 hp motors with multiguard protection are shown in a 4-p brochure, SB-1345. The Lincoln Electric Co, Cleveland 17, Ohio.

• **SCHOOL LIGHTING:** A non-technical 8-p booklet explains factors of efficient lighting in the classroom and secondary areas of schools. Garcy Lighting, 2475 Elston Ave., Chicago 47, Ill.

Report on
**Utility Earnings**




# 1957 Net Incomes Rose 5.9%

**Net incomes of electric utilities continued their upward climb in 1957.** A study of the year-end statements of 90 companies shows that their combined net (before all dividends) reached $968,881,929 for a 5.9% gain over 1956.

**Several trends show up in the financial statements of the 90 companies:**

- Gross revenues went up, even for the companies whose net income declined.
- Operating expenses, maintenance, and depreciation were generally on the upside, although some companies were able to buck the trend.
- Federal income taxes showed relatively small increases, and for many companies were actually lower than in '56. This is largely attributable to accelerated amortization and liberalized depreciation. "Other" taxes, however, were well up. One company paid 16% more other taxes—on less income.
- Use of the "interest charged to construction" credit increased in '57. This is a credit to income account and a debit to plant account, designed to keep reported income from falling too low while a company is building a plant but before it is fully used. A comparative study of the interest during construction credit for 100 utilities made by Ted Locke, security analyst of Goodbody & Co, provides some examples of its importance to an expanding utility. Washington Water Power Co's interest during construction amounted in 1957 to $1,613,388—about 28% of net income. The Goodbody study shows that this credit came to 69¢ per share of common stock, and expects it to go "substantially higher" in 1958. Central Illinois Light Co and Idaho Power Co also registered over 60¢ per share. A copy of the complete report is available from Ted Locke, Goodbody & Co, 115 Broadway, New York 6, N. Y.

**This year EW looks for a further 7% gain to $1,035,000,000.** We base this forecast on more business and more rate increases in effect in 1958.

# Net Incomes for 90 Operating Electric Utilities

(for calendar years 1957 and 1956)

| COMPANY | 1957 | 1956 |
|---|---|---|
| Alabama Power* | $16,975,367 | $15,388,955 |
| Appalachian Electric Power* | 17,916,186 | 15,680,171 |
| Arkansas Power & Light* | 8,355,647 | 6,335,372 |
| Atlantic City Electric | 5,150,952 | 4,777,408 |
| Baltimore Gas & Electric | 17,550,000 | 16,006,000 |
| Bangor Hydro-Electric | 1,080,895-D | 1,260,060 |
| Black Hills Power & Light | 789,491 | 749,696 |
| Blackstone Valley Gas & Electric | 1,625,929 | 1,484,516 |
| Brockton Edison | 1,177,613 | 1,050,582 |
| California Electric Power | 3,802,164 | 3,577,675 |
| California-Pacific Utilities | 766,596 | 757,382 |
| Carolina Power & Light | 11,492,530 | 10,338,746 |
| Central Hudson Gas & Electric | 4,014,355 | 3,674,804 |
| Central Illinois Electric & Gas | 3,189,382 | 3,090,968 |
| Central Illinois Light | 5,395,583 | 4,886,541 |
| Central Illinois Public Service | 9,652,141 | 9,007,234 |
| Central Louisiana Electric | 2,694,071 | 2,462,033 |
| Central Maine Power | 6,917,473 | 6,826,376 |
| Central Vermont Public Service | 1,344,893-D | 1,367,507 |
| Colorado Central Power | 579,289 | 497,377 |
| Columbus & Southern Ohio Elec. | 7,794,026 | 6,780,318 |
| Community Public Service | 1,600,002 | 1,497,109 |
| Connecticut Light & Power | 11,258,318 | 10,623,952 |
| Connecticut Power | 2,551,423 | 2,309,359 |
| Consolidated Edison of N Y | 56,697,839 | 53,397,699 |
| Consumers Power | 32,763,015 | 31,187,282 |
| Dallas Power & Light* | 8,250,590 | 7,461,562 |
| Dayton Power & Light | 10,315,000-D | 10,959,000 |
| Delaware Power & Light | 7,201,951 | 6,249,203 |
| Detroit Edison | 32,718,555 | 29,376,407 |
| Duquesne Light | 19,167,544 | 18,585,162 |
| Empire District Electric | 1,723,373-D | 1,814,063 |
| Florida Power & Light | 20,394,478 | 17,138,754 |
| Georgia Power* | 17,960,906 | 15,442,035 |
| Gulf Power* | 3,064,047 | 2,853,074 |
| Gulf States Utilities | 11,759,236 | 11,074,762 |
| Hartford Electric Light | 4,551,225 | 4,242,123 |
| Houston Lighting & Power | 18,946,567 | 17,543,827 |
| Idaho Power | 6,426,978 | 5,770,766 |
| Illinois Power | 14,599,192 | 14,145,330 |
| Indiana & Michigan Electric* | 10,158,731 | 9,465,236 |
| Iowa-Illinois Gas & Electric | 5,359,592 | 5,031,563 |
| Iowa Power & Light | 4,845,000 | 4,745,525 |
| Iowa Public Service | 3,857,124 | 3,801,377 |
| Iowa Southern Utilities | 1,698,380 | 1,498,369 |
| Kansas City Power & Light | 9,877,486 | 9,241,508 |
| Kansas Gas & Electric | 6,075,632 | 5,860,534 |
| Kansas Power & Light | 7,000,616 | 6,888,210 |
| Kentucky Power* | $1,336,555-D | $1,398,322 |
| Kingsport Utilities* | 381,807 | 321,452 |
| Long Island Lighting | 12,581,000 | 12,472,839 |
| Louisville Gas & Electric | 7,748,911 | 7,311,495 |
| Maine Public Service | 660,215 | 561,863 |
| Minnesota Power & Light | 4,860,728 | 4,150,858 |
| Mississippi Power* | 3,108,462 | 2,546,901 |
| Mississippi Power & Light* | 4,536,904 | 4,364,500 |
| Missouri Public Service | 2,210,775 | 1,874,652 |
| Montana Power | 10,630,795 | 10,136,814 |
| New England Gas & Electric | 3,707,509 | 3,566,751 |
| N. Y. State Electric & Gas | 11,715,801 | 11,585,940 |
| Niagara Mohawk Power | 26,430,000-D | 28,397,000 |
| Northern States Power | 21,161,801 | 20,471,283 |
| Ohio Edison | 25,856,623 | 24,768,944 |
| Oklahoma Gas & Electric | 9,724,044 | 9,428,977 |
| Ohio Power* | 19,734,614 | 17,886,799 |
| Otter Tail Power | 1,930,963 | 1,894,591 |
| Pacific Gas & Electric | 76,620,000 | 75,774,000 |
| Pennsylvania Power & Light | 22,850,777-D | 23,465,984 |
| Philadelphia Electric | 37,162,471 | 35,473,099 |
| Portland General Electric | 5,769,154 | 5,192,079 |
| Potomac Electric Power | 10,054,300 | 9,521,261 |
| Public Service Electric & Gas | 34,384,882 | 32,035,326 |
| Public Service of New Hampshire | 4,790,326 | 4,650,405 |
| Public Service of Oklahoma | 8,220,552 | 7,811,636 |
| Rochester Gas & Electric | 6,740,149 | 6,473,235 |
| Rockland Light & Power | 2,373,944 | 2,197,800 |
| St. Joseph Light & Power | 1,132,078 | 1,002,029 |
| Sierra Pacific Power | 1,523,008 | 1,495,596 |
| Southern California Edison | 31,986,000-D | 33,657,332 |
| Southern Indiana Gas & Electric | 2,744,639 | 2,312,300 |
| Southwestern Public Service | 8,487,207 | 8,009,367 |
| Tampa Electric | 4,355,899 | 4,024,517 |
| Texas Electric Service* | 14,962,331 | 13,451,092 |
| Texas Power & Light* | 12,618,242 | 11,745,978 |
| Toledo Edison | 6,548,351 | 6,524,564 |
| Tucson Gas Electric Light & Power | 2,474,672 | 2,173,881 |
| Utah Power & Light | 8,791,308 | 7,525,812 |
| Virginia Electric & Power | 24,502,536 | 21,135,879 |
| Washington Water Power | 5,704,734 | 5,364,386 |
| Wisconsin Power & Light | 6,679,479 | 6,359,004 |
| **Total—90 companies** | **$968,881,929** | **$914,720,055** |

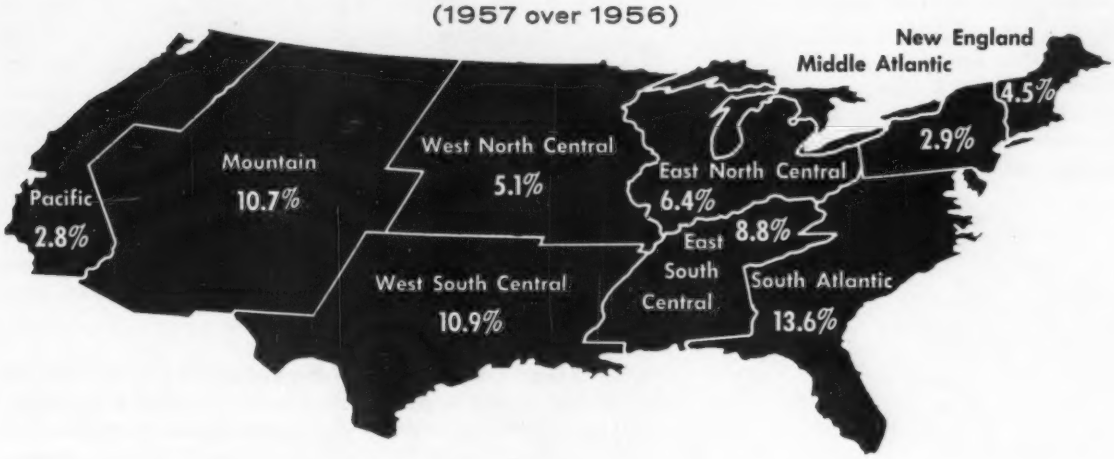
*—Indicates all common shares are owned by a holding company.

D—Indicates decrease from 1956.

**In 1957 the South Atlantic Region posted the largest income gain—13.6%.** Not far behind came the West South Central and Mountain Regions, with 10.9% and 10.7% respectively. All regions showed gains over their 1956 income figures, but there was a noticeable shift of top earnings to the Southeast. The South Atlantic and East South Central Regions each improved their rate of increasing income by a full percentage point. The Mountain Region improved by one tenth of a point, but all other areas showed a tendency to level out. Lowest rate of increase was 2.8% in the Pacific Region, where incomes had jumped almost 9% the year before.

## Regional Breakdown of Net Income Increases

(1957 over 1956)




**Pacific Gas & Electric Co rang up the largest 1957 net—$76,620,000**—on gross operating revenues of $501,244,000. It was the first time the San Francisco utility had taken in a half billion dollars, but the highest gross was recorded by Consolidated Edison Co of New York—with $522,668,962. Con Ed carried $56,697,839 down to net income.

**But the biggest percentage gainer was Mississippi Power Co with a 22% gain.** MP Co did it by collecting a $1.7 million higher gross, and cutting operating expenses slightly at the same time. Its sister utility in the Southern Co system, Georgia Power Co, also made the top ten with a 16.3% increase. The Southern Co itself, nourished by its subsidiaries in the booming South, reported a $4.7 million gain (15.6%) over 1956 income.

**Pressing Mississippi Power for the top spot came Florida Power & Light Co,** with a 19%, $3¼ million rise. Since 1955, when EW began keeping tabs on these 90 companies, Florida P&L has advanced seven steps (from 20th to 13th) on the list ranking them in order of highest net. In the short space of two years its net income has gone up almost 50%.

**In third place this year is tiny Kingsport Utilities,** smallest utility in the sample. The Tennessee subsidiary of American Gas & Electric Co made $60,355 more in '57 than it had in '56, when it was one of nine companies to show earnings declines. Kingsport was one of the few companies which paid less state & local taxes in '57. Its taxes other than federal income tax declined by $59,445—an amount almost equal to its income gain.

**A rate hike helped Southern Indiana Gas & Electric Co climb to fourth place,** after having shown an earnings decline in 1956. In '57, net went up 18.7%.

## These Ten Showed Largest Gains over '56

| Company | Percent Increase |
|---|---|
| Mississippi Power | 22.0 |
| Florida Power & Light | 19.0 |
| Kingsport Utilities | 18.8 |
| Southern Indiana Gas & Electric | 18.7 |
| Missouri Public Service | 17.9 |
| Maine Public Service | 17.5 |
| Minnesota Power & Light | 17.1 |
| Utah Power & Light | 16.8 |
| Colorado Central Power | 16.5 |
| Georgia Power | 16.3 |

## Eight Companies Had Lower Net Incomes

(1957 Versus 1956)

| Company | Amount |
|---|---|
| Bangor Hydro-Electric | $ 179,165 |
| Central Vermont Public Service | 22,614 |
| Dayton Power & Light | 644,000 |
| Empire District Electric | 90,690 |
| Kentucky Power | 61,767 |
| Niagara Mohawk Power | 1,967,000 |
| Pennsylvania Power & Light | 615,207 |
| Southern California Edison | 1,671,332 |
| Total | $5,251,775 |

**Earnings fell in '57 for eight companies.** Three of them have recently been granted rate increases, but two of the hikes came too late to have much effect on '57 income, and the third was approved in 1958.

**Southern California Edison Co's net income dropped by $1,671,332,** in spite of a substantial $22 million gain in gross revenue and a $2.8 million cut in purchased power. Biggest additional expense was fuel, which went up 53% over 1956 to almost $40 million. Taxes other than federal income tax and operating expenses went up about $3.5 million each, but the company was still able to bring a $1.3 million gain over 1956 down as far as total income. Bond interest ran $3 million higher than in '56, however, and net income ended 5% off. A rate increase granted in 1957 only was in effect a fraction of the year, and with the higher rates in effect in '58, earnings are expected to rise.

**The only repeater on the declining income list is Niagara-Mohawk Power Corp.** Benefits of a rate increase which went into effect Aug. 31 were reflected only in November and December, and the company looks for a better year in '58. In 1957, Niagara-Mohawk's net shrank to $26,430,000—a drop of $1,967,000, or about 7%. While operating revenue increased by $5.6 million, operating expenses jumped by $8.4 million, more than offsetting the gain. Niagara-Mohawk, incidentally, was the only company to pay more federal income tax on less income. This quirk stems from the fact that in 1956 the company took a $3.8 million tax credit for part of the loss of its Schoellkopf plant.

**Empire District Electric Co showed a dip in net of 5%,** although revenue went up and operating expenses declined. Taxes other than federal income tax shot up almost 16%—the increased taxes alone were more than enough to account for the company's $90,690 decrease in net income. Rate increases granted this year in Missouri, Kansas, and Oklahoma should help lift '58 income.

**Largest percentage decline in income beset Bangor Hydro-Electric Co—14.2%.** And the Maine utility's last quarter statement showed a 29.4% income dip from fourth quarter '56. Bangor still stands well above its 1955 position, however, since it registered a 31% gain in '56 to stand second in percentage gain for that year. Bangor's story in '57 is echoed by many northeastern utilities—a leveling out of revenue while operating expenses kept rising rapidly.

# Build lines to stay with the CHANCE 8-WAY

## THE EXPANDING ANCHOR WITH ALL 'ROUND HOLDING POWER

All 8-Way Anchor Rods have the Chance-developed Thimbleye that protects your guy strand.

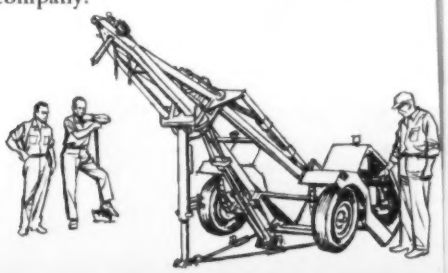
**8-WAY EXPANDING ANCHORS FOR STRONGER GUYS** · · · Only the Chance 8-Way Expanding Anchor, with its 8 rib reinforced blades, expands into solid earth *all the way around* to form a pyramid-like square.

Chance engineers, who have devoted their careers to developing and testing guying equipment, find that this design adds strength to expanding anchors. The pyramid enlarges the effective area of the anchor's holding power. Blades that expand side by side leave no wasted space between them, can be shorter—less apt to bend, and expand in a wide area of solid earth all around the hole.

That is why field test after field test made for power companies all over the country show that the Chance 8-way usually holds well beyond its rated load, and that is why it is on so many company standards.

Make the Chance 8-way *your* standard for the kind of T and D line guying you can install and forget.

**CHANCE FIELD ASSISTANCE AIDS IN ANCHOR SELECTION** · · · To assist you in anchor selection, to demonstrate the best installation methods and to test the results under specific soil conditions, the A. B. Chance Co. puts a nationwide team of anchoring experts at your service. These Regional Guying Specialists have the practical experience and technical knowledge to demonstrate proper anchoring to your field men. They have hydraulic testing equipment for on-location field tests to help determine what Chance anchors are right for your system. Call the nearest Chance Regional Manager in your area or ask the Chance Sales Representative to schedule a demonstration for your company.



*Guys never had it so solid!*

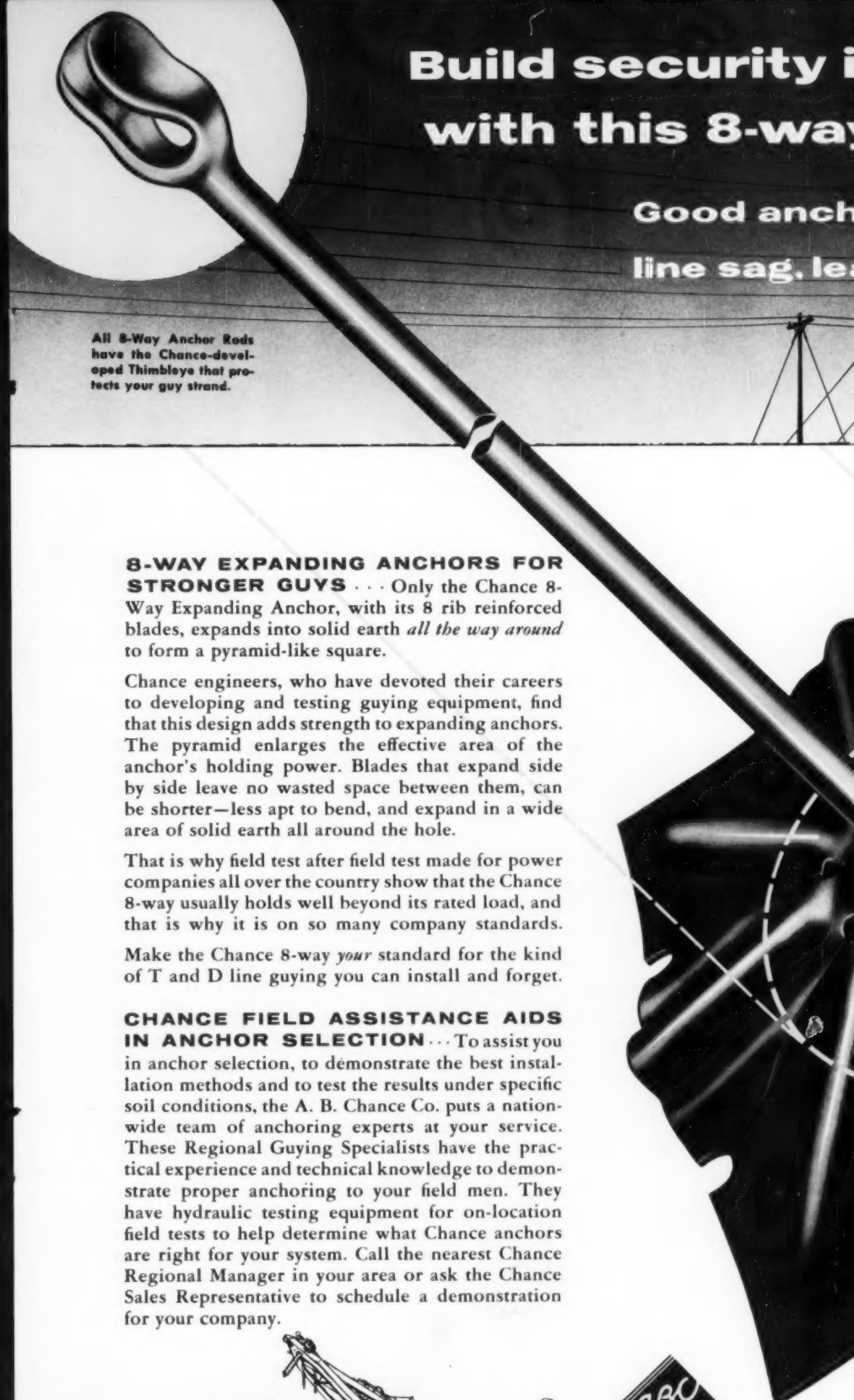
You can see the Chance 8-way slips right down in a hole no bigger'n the base plate. Now flip this flap to get a mole's eye view of how it expands below "see" level.

*Mike the Mole*
Underground Observer

# Build security i
# with this 8-way

## Good anch
## line sag, le

All 8-Way Anchor Rods have the Chance-developed Thimbleye that protects your guy strand.



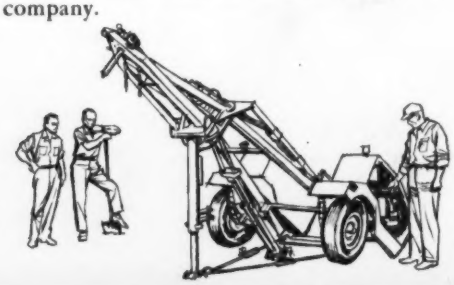
**8-WAY EXPANDING ANCHORS FOR STRONGER GUYS** . . . Only the Chance 8-Way Expanding Anchor, with its 8 rib reinforced blades, expands into solid earth *all the way around* to form a pyramid-like square.

Chance engineers, who have devoted their careers to developing and testing guying equipment, find that this design adds strength to expanding anchors. The pyramid enlarges the effective area of the anchor's holding power. Blades that expand side by side leave no wasted space between them, can be shorter—less apt to bend, and expand in a wide area of solid earth all around the hole.

That is why field test after field test made for power companies all over the country show that the Chance 8-way usually holds well beyond its rated load, and that is why it is on so many company standards.

Make the Chance 8-way *your* standard for the kind of T and D line guying you can install and forget.

**CHANCE FIELD ASSISTANCE AIDS IN ANCHOR SELECTION** . . . To assist you in anchor selection, to demonstrate the best installation methods and to test the results under specific soil conditions, the A. B. Chance Co. puts a nationwide team of anchoring experts at your service. These Regional Guying Specialists have the practical experience and technical knowledge to demonstrate proper anchoring to your field men. They have hydraulic testing equipment for on-location field tests to help determine what Chance anchors are right for your system. Call the nearest Chance Regional Manager in your area or ask the Chance Sales Representative to schedule a demonstration for your company.



ABC INDUSTRIES

**A·B·CHANCE CO., C**

(A·B·Chance Co. of Ca

# y into your T and D line$
# way Expanding Anchor...

**nchoring is *low-cost insurance* against**
**, leaning poles and storm damage.**

Bottom view of the expanded 8-way shows how the eight blades expand to form a square—with no wasted space between blades. Nut retainer aids installation.

**CO., Centralia, Missouri**
. of Canada, Ltd., Toronto)

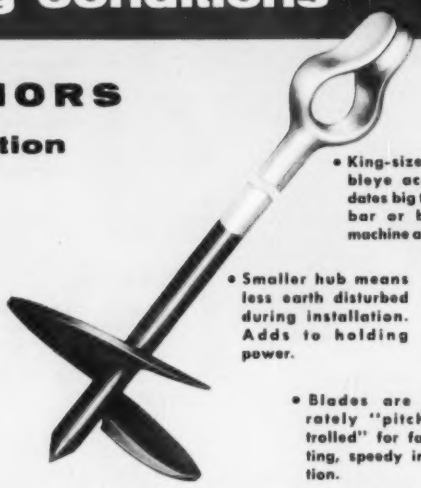
# . . . and there are CHANCE ANCHORS for all other soil and guying conditions

## CHANCE SCREW ANCHORS

### for cost-cutting machine installation or hand installation

Many utilities which use screw anchors cut their installation time to a fraction by installing Chance Screw Anchors with hole boring equipment. They use the Chance "Blackfoot"* anchor because it is designed to screw down fast with little earth disturbance. This not only means less difficulty with installation equipment, but greater holding power and easier installation of the anchors that are to be screwed down by hand.

*The line crew's name for the line crew's choice.



- King-size thimbleye accomodates big turning bar or boring machine adapter.
- Smaller hub means less earth disturbed during installation. Adds to holding power.
- Blades are accurately "pitch-controlled" for fast-cutting, speedy installation.

## CHANCE PLATE ANCHORS

### for heavy transmission line guying

CHANCE CROSS-PLATE ANCHOR

When you're guying "big stuff" like transmission lines, you want anchors that will hold the load for the life of the lines.

The Chance Cross-Plate Anchor was designed specifically for installation in vertical machine bored holes to save time and money on transmission line construction. Costs 50% less than a log dead-man —holds more.

Chance Never-Creep Anchors pull entirely against solid, undisturbed earth to hold more load than any other type. Installed in angled hole —hand or machine bored.

Send for Bulletin 865: "How to Get Better Transmission Line Guying for Less."

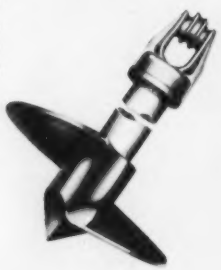
CHANCE NEVER-CREEP ANCHOR

## FOR ROCKY AREAS

Chance Expanding Rock Anchors wedge into solid rock. Chance Cone Anchors wedge against tamped rock.

## FOR SWAMPLAND

Chance Swamp Screw Anchors screw down to any depth required for a firm grip.



## FOR POLE KEYING

Chance Pole Keys expand at the butt of the pole for reinforcement in soft soil. Eliminate need for trench digging to install keys.

### SEND FOR YOUR COPIES OF "ANCHORING"

**Here is the most complete guide to better anchoring ever developed. It's full of how-to-do-it material to help you select the right anchor for every guying job—and get it installed properly.**

**A•B•CHANCE CO., Centralia, Missouri**

(A•B•Chance Co. of Canada, Ltd., Toronto)

CA58-1

# The Meetings Calendar

## MARCH

• **Electric Companies Public Information Program**—Inter-Regional Committee, Blackstone Hotel, Chicago, Ill., March 5; Steering Committee, Biltmore Hotel, New York City, March 12; Mid-Atlantic Regional Meeting, Baltimore, Md., March 19.

**Right of Way Meeting** — Electrical World's second conference on R/W practices, procedures, and problems, Conrad Hilton Hotel, Chicago, Ill., March 6-7.

**Pacific Coast Electrical Association** — Business Development Section, Statler Hotel, Los Angeles, Calif., March 6-7; Engineering & Operation Section, Sheraton Palace, San Francisco, Calif., March 27-28.

**Lighting Lamps and Electrical Manufacturers Salesmen's Association**—First National Lighting Exposition, Coliseum, New York City, March 9-12.

**Nuclear Congress**—Co-sponsored by American Society of Mechanical Engineers and the Engineers Joint Council, International Amphitheater, Chicago, Ill., March 16-22.

**Interstate Power Club** — Hotel Martinique, New York City, March 17.

• **American Council to Improve Our Neighborhoods**—Building Industry Congress on Urban Renewal, co-sponsored by the National Housing Center, Washington, D. C., March 17-18.

**National Association of Corrosion Engineers**—Annual Conference & Exhibition, Municipal Auditorium, San Francisco, Calif., March 17-21.

**American Institute of Electrical Engineers and American Society of Mechanical Engineers**—Joint Management Conference Committee, Hotel Somerset, Boston, Mass., March 19-20; Southwest District Meeting, Mayo Hotel, Tulsa, Okla., March 31-April 2.

**Edison Electric Institute** — Industrial Relations Committee, Headquarters, New York City, March 20; Annual Sales Conference, Edgewater Beach Hotel, Chicago, Ill., March 24-27.

**Institute of Radio Engineers**—National Convention, Waldorf-Astoria Hotel and New York Coliseum, New York City, March 24-27.

**Northwest Public Power Association**—Engineering and Operations Section, Clark County PUD Electric Center, Vancouver, Wash., March 26-27.

**American Power Conference**—20th Anniversary Meeting, Sherman Hotel, Chicago, Ill., March 26-28.

**Oklahoma Utilities Association** — Annual Convention, Oklahoma Biltmore Hotel, Oklahoma City, Okla., March 27-28.

**Electrical Maintenance Engineers Association of Southern California**—Industrial Electric Show and Conference, Shrine Convention Hall, Los Angeles, Calif., March 27-29.

• **Agricultural and Mechanical College of Texas**—First Annual Texas Conference on the Utilization of Atomic Energy, College Station, Texas, March 31-April 2.

**Southeastern Electric Exchange**—Annual Meeting, Boca Raton Hotel and Club, Boca Raton, Fla., March 31-April 2.

## APRIL

**Rural Electrification Administration** — 9th Annual Electric Generating Plant Operation and Maintenance Conference, Phoenix Hotel, Lexington, Ky., April 7-10.

**Indiana Electric Association**—Young Men's Utility Conference, Evansville, Ind., April 8-9.

**Microwave Research Institute** — Symposium on Electronic Waveguides held in cooperation with Institute of Radio Engineers, New York City, April 8-10.

**Rocky Mountain Electric League**—Spring Conference, Shirley-Savoy Hotel, Denver, Colo., April 13-15.

**American Institute of Electrical Engineers**—Rubber and Plastics Industries Subcommittee, Mayflower Hotel, Akron, Ohio, April 14-15; Middle Eastern District Meeting, Washington, D. C., April 28-30.

**Edison Electric Institute**—National Conference of Electric and Gas Utility Accountants, held jointly with AGA, Shamrock Hilton Hotel, Houston, Texas, April 14-16; Industrial Relations Committee, Headquarters, New York City, April 17; Accident Prevention Committee, Commodore Perry Hotel, Toledo, Ohio, April 27-30; Purchasing and Stores Committee Meeting, Hotel Nicollet, Minneapolis, Minn., April 28-30.

**American Welding Society**—Sixth Annual Welding Show, and Technical Meeting, Kiel Auditorium and Hotel Statler, St. Louis, Mo., April 14-18.

**Northwest Electric Light & Power Association**—Engineering & Operating Section, combined with Personnel & Safety Section and Purchasing Committee, Chinook Hotel, Yakima, Wash., April 23-25.

**Agricultural and Mechanical College of Texas**—11th Annual Conference for Protective Relay Engineers, College Station, Texas, April 14-16.

**Missouri Valley Electric Association**—Engineering Conference, President Hotel & Municipal Auditorium, Kansas City, Mo., April 16-18.

**Northwest Public Power Association, Inc.**—Annual Membership Meeting, Ridpath Hotel, Spokane, Wash., April 16-18.

**Southeastern Electric Exchange**—Engineering and Operations Meeting, Buena Vista Hotel, Biloxi, Miss., April 21-23.

**Pacific Coast Electrical Association**—Administrative Services Section, Hotel Valley Ho, Scottsdale, Ariz., April 23-24.

**Pennsylvania Electric Association**—Meter Committee, Galen Hall Hotel, Wernersville, Pa., April 24-25.

## MAY

• **American Society of Tool Engineers**—26th Annual Meeting and Tool Show, Philadelphia Convention Center, Philadelphia, Pa., May 1-8.

• **Edison Electric Institute** — Area Development Committee, New York City, May 1; Commercial Cooking Conference, Chicago, Ill., May 6.

• **Air Conditioning and Refrigeration Institute**—Annual Meeting, The Homestead, Hot Springs, Va., May 4-7.

• **National Electrical Contractors Association**—Districts Six, Eight and Nine Annual Conference, Hotel Biltmore, Los Angeles, Calif., May 5-7.

**American Public Power Association**—Annual Meeting, New Orleans, La., May 6-8

**Pennsylvania Electric Association**—Electric Equipment Committee, Skytop Lodge, Skytop, Pa., May 8-9.

**National Association of Purchasing Agents**—Annual Convention, Chicago, May 11-14.

---

• Additions this week.

### MORE BIG DATES FOR '58

**Edison Electric Institute**—26th Annual Convention, Boston, June 9-12.

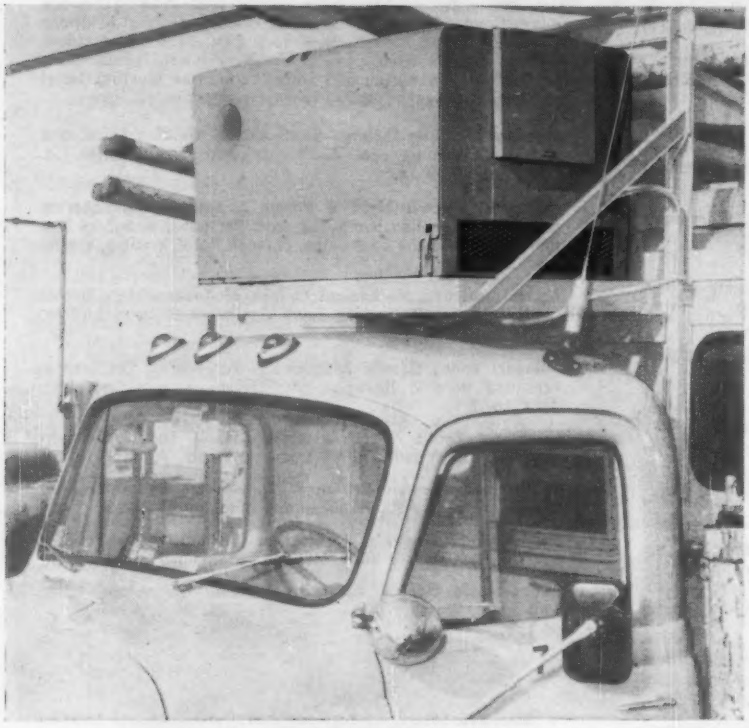
**American Institute of Electrical Engineers** — Summer General Meeting, Buffalo, June 22-27.

**National Electrical Manufacturers Association**—Annual Meeting, Atlantic City, Nov. 10-14.

Onan ELECTRIC PLANTS

ELECTRIC PLANT NEWS

Onan ELECTRIC PLANTS



*For keeping radio batteries charged . . .*

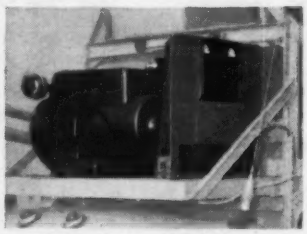
**Truck-mounted Onan Electric Plant saves 6-10 gallons of gas per day!**

**Operates Onan Rectifier Battery Charger installed in truck body; delivers 2,000 watts A.C. for tools and lights**

This 2KW Onan Plant, driven by a single-cylinder, air-cooled engine of 5 H.P. makes it unnecessary to run the 150 H.P. truck engine for battery charging. It saves gasoline and cuts down on truck engine maintenance. Savings of from $2.00 per day to $800.00 per year per truck have been reported. Moreover, the electric plant supplies 2 KW of *plug-in power* for electric saws, drills and lights used in construction and maintenance.

The installation above has the plant mounted over the truck cab. Other companies have installed units within the truck body. Onan air-cooled plants equipped with the optional, low-cost Vacu-Flo system *can be completely enclosed.*

There's an Onan Packaged Power system that can cut your costs substantially. Describe your need and let us help you.



**ONAN MODEL 2LK-IRV** shown with weatherproof steel housing removed. Mounting frame is attached to truck body. Plant is accessible for servicing. Entire unit can be transferred easily to new trucks. This plant is started electrically.

***Special folder F-111 describes 3 Onan battery charging systems. Write or call.***

**D. W. ONAN & SONS INC.**

2824A University Ave. S.E., Minneapolis 14, Minnesota

ELECTRIC PLANTS • AIR-COOLED ENGINES • KAB KOOLER • GENERATORS

Onan ELECTRIC PLANTS


# Books

### Fundamentals of Electricity

*A Second Course of Electricity.* By A. E. E. McKenzie. Published by Cambridge University Press, 32 E 57th St, New York 22, N. Y. 309 pages, illustrated. Price $3.50.

This book presents the usual material found in text books on the fundamentals of electricity. Atomic physics and some material on electronics are also presented. The true mark of a text book, many problems, is readily apparent. The rationalized M.K.S. system of units is used by the author.

### Electronics Handbook

*Reference Data for Radio Engineers.* H. P. Westman, Editor. Published by International Telephone & Telegraph Corp, 67 Broad St, New York 4, N. Y. 1150 pages, illustrated. Price, $6.00.

In its fourth edition, this comprehensive handbook has been expanded to include more recent information on transistors and semi-conductors, information theory, nuclear reactors, and digital computers. Material on standards has been considerably enlarged and brought up to date.

### Books Received Since Dec. 13, 1957

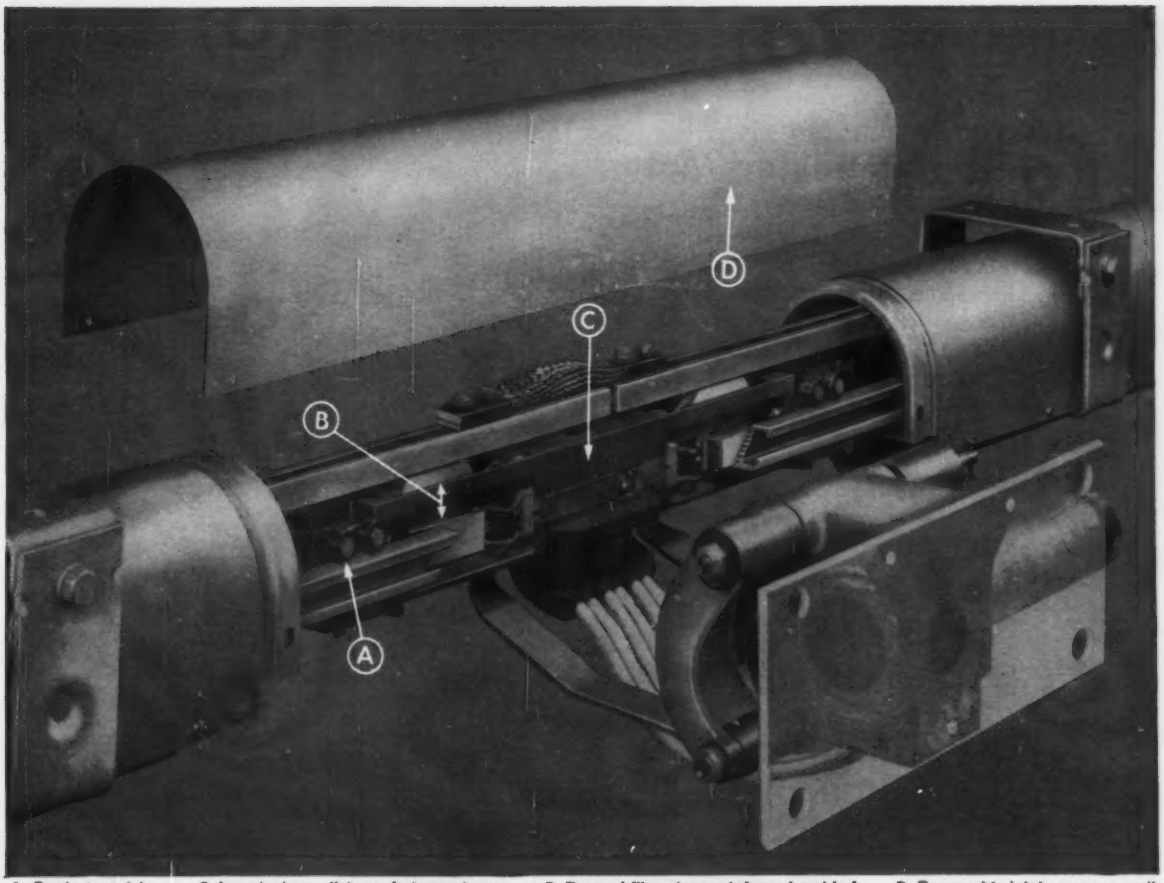
*Electrical Construction Cost Manual.* By Ralph E. Johnson. Published by the McGraw-Hill Book Co, Inc, 330 W 42nd St, New York 36, N. Y. 448 pages, illustrated. Price $10.00.

*Heat Transfer, Volume II.* By Max Jakob. Published by John Wiley & Sons, Inc, 440 Fourth Ave, New York 16, N. Y. 600 pages, illustrated. Price $15.00.

*National Electrical Code Handbook, Ninth Edition.* Revised by Charles L. Smith. Published by McGraw-Hill Book Co, 330 W 42nd St, New York 36, N. Y. 625 pages, illustrated. Price $8.00.

*Engineering Materials Handbook.* Prepared by a Staff of Specialists. Published by McGraw-Hill Book Co, 330 W 42nd St, New York 36, N. Y. 1,936 pages, illustrated. Price $21.50.

*Basic Electric Circuit Theory.* By Walter W. Lewis. Published by The Ronald Press Co, 15 E 26th St, New York 10, N. Y. 650 pages, illustrated. Price $9.00.

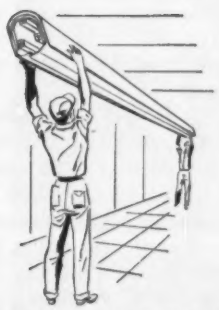



**A.** Sealed and insulated wheels. **B.** Long leakage distance between large special-alloy sliding contacts. **C.** Rugged fibreglass-reinforced molded polyester trolley conductor body. **D.** Removable joint covers permit easy accessibility to trolley unit.

# AN OUTSTANDING SAFETY ADVANCE

## in supplying power to cranes

# LEC-TROL-FEED®



Two men can handle 30-foot sections of LEC-TROL-FEED system with ease.

Here is undoubtedly the finest traveling-contact equipment on the market. LEC-TROL-FEED provides the utmost in safety and dependability for the powering of cranes and other equipment traveling on straight runways, such as hoists, conveyor-belt trippers, and automatic welding units. A unique safety slot in bottom cover offers maximum protection against accidental contact with live bus bars. And your installation and maintenance costs with a LEC-TROL-FEED system are drastically lower than with ordinary trolley systems.

Rugged precision design for easy installation and minimum maintenance. Specifically engineered to eliminate the problems encountered through dirt accumulation in ordinary trolley systems. Truly the best and safest busway system you can buy. Available with bronze, aluminum, or copper bus bars, in ratings of 180, 260, and 330 amperes respectively. Standard trolley illustrated above rated 100 to 130 amperes. Higher amperages available with multiple-trolley installations.

**FREE BROCHURE.** The full story on LEC-TROL-FEED is given in this illustrated folder. Get one from your nearest Delta-Star representative, who will supply engineering specifications based on your installation requirements and operating conditions. Or write DELTA-STAR ELECTRIC DIVISION, H. K. PORTER COMPANY, INC., 17th and Cambria Sts., Philadelphia 32, Pa. District offices in principal cities

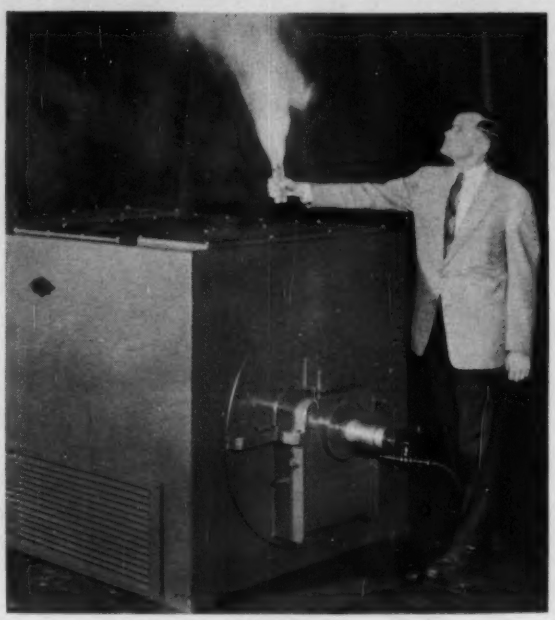
# H. K. PORTER COMPANY, INC.

## DELTA-STAR ELECTRIC DIVISION

Connors Steel, Delta-Star Electric, Disston, Forge and Fittings, Leschen Wire Rope, Quaker Rubber, Refractories, Riverside-Alloy Metal, Vulcan Crucible Steel, H. K. Porter Company (Canada) Ltd.

# Manufacturers and Markets

## Straight-Up Ventilated Motor Introduced by E-M



An induction motor developed by Electric Machinery Mfg Co, Minneapolis, Minn., for boiler feed pump service features top air "Straight-Up" ventilation and acoustically correct "silent" operation. The straight-up principle is illustrated in the photo by a smoke bomb held in the outlet air stream. The motor is rated at 1250-hp, 3600 rpm, 2300-v, and is destined for the Dairyland Power Coop.

This line of motors (type SUV) is suitable for side-by-side installation and reportedly eliminates the usual interchange of ventilating air. The motors draw air in the bottom and expel it straight up. They are also treated acoustically for a low noise level to meet a requisite for power plants.

### PG&E Ordered 300-Mw Westinghouse T-G Unit

A multimillion dollar turbine-generator with a guaranteed capacity of 300 Mw is being built by Westinghouse Electric Corp for the Pacific Gas & Electric Co. It is expected to generate up to 325 Mw and will go into service in 1960. The output will boost PG&E's Pittsburg, Calif., power plant capacity by 50%.

The new machine will be almost twice as large as any now in service on the utility's system. A cross-compound type, it will be installed outdoors and will operate at 2400 psi, 1050F. Each of the two shafts will spin at 3,600 rpm.

### Koppers Precipitator Has Barbed Electrodes

Successful application of a new type of electrode for the field of industrial gas cleaning and air pollution control has been announced by the Metal Products Division of Koppers Co, Inc.

Having evenly spaced groups of barbs, the new device achieves complete control of the corona discharge on the energizing electrodes of electrostatic precipitators. This device has been performing successfully for a year at a large power generating plant in England, according to the company.

### Luminaire Identification Changed by Line-Material

A new system of street lighting luminaire identification and catalog numbering has been established by Line Material Industries, Milwaukee, Wis. The system is tailored to make ordering easy.

Hereafter fluorescent luminaires will be identified as Line 1, mercury vapor luminaires as Line 2, incandescent luminaires as Line 3.

Two new publications are now available—Bulletin SL1 on Line 3, Incandescent Luminaires, and Bulletin SL6 on Line 1, Fluorescent Luminaires.

A new street lighting catalog is expected to be ready later this year. It will follow the basic style of the SL1 bulletin—each luminaire will be identified by photographs, IES light patterns, and catalog numbers.

### GE Sales and Earnings Set Records in 1957

General Electric Co continued its pattern of postwar growth. Sales and earnings in 1957 set records in both categories according to a recent announcement by President Ralph J. Cordiner. New records also were established in employee earnings and payments to suppliers.

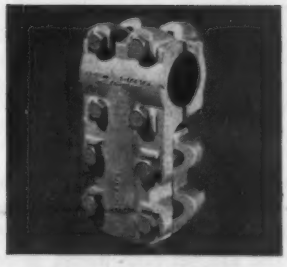
Net sales billed in 1957 totaled $4,335,664,061, which is 6% higher than the previous record of $4,090,015,685 set in 1956. This is 25% higher than 1955 sales of $3,463,734,419.

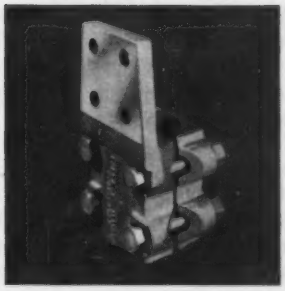
Net earnings in 1957 amounted to $247,851,871, or $2.84 a share, an increase of 16% over 1956 earnings of $213,756,849, or $2.46 a share. The earnings were equivalent to 5.7 cents of each sales dollar as compared with 5.2 in 1956.

Cordiner said 1957 earnings performance reflected "some progress" toward a level of earnings adequate to support research and development and provide new employment opportunities and new products necessary to the growth of the American economy.

(*More M&M on page* 126)

EASY INSTALLATION. Bolt heads fall naturally into locking lugs on connector walls, making installation fast and sure with one wrench.





# ...assured with Delta-Star heavier-duty aluminum connectors

Delta-Star offers you a *complete line* of NEMA-standard aluminum conductor connectors. Their generous overall proportions and their contact surfaces which precisely match those of the conductors help assure maximum contact area and minimum contact resistance. Heavy cast-aluminum walls throughout make these Delta-Star Connectors rugged and immune to distortion under the most rigorous service.

Delta-Star Connectors are supplied in types and sizes to meet all requirements.

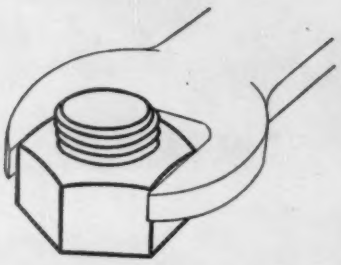
For complete information, write today to **Delta-Star Electric Division, H. K. Porter Company, Inc., 2437 Fulton St., Chicago 12, Illinois. District offices in principal cities.**

## H. K. PORTER COMPANY, INC.

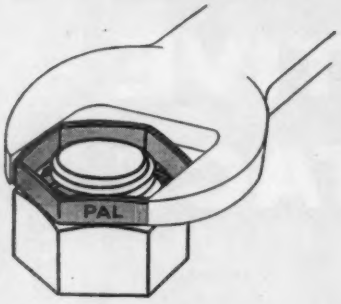
DELTA-STAR ELECTRIC DIVISION

Connors Steel, Delta-Star Electric, Disston, Forge & Fittings, Leschen Wire Rope, Quaker Rubber, Refractories, Riverside-Alloy Metal, Vulcan Crucible Steel, H. K. Porter Company (Canada) Ltd.

Get it tight—



then KEEP it tight




with a

PALNUT LOCK NUT

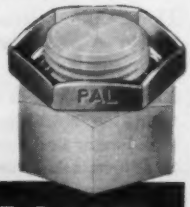
JUST spin on a PALNUT Lock Nut and lock with 1/3 turn of a wrench. Takes but seconds, cost is negligible, protects for the life of the installation. PALNUT Lock Nuts exert a double locking action that prevents the plain nut from loosening and the bolt from backing out, under severest vibration. Eliminates further checking or re-tightening on mechanical assemblies —maintains perfect conductivity on electrical connections.

*Widely Used Throughout Utility Field*

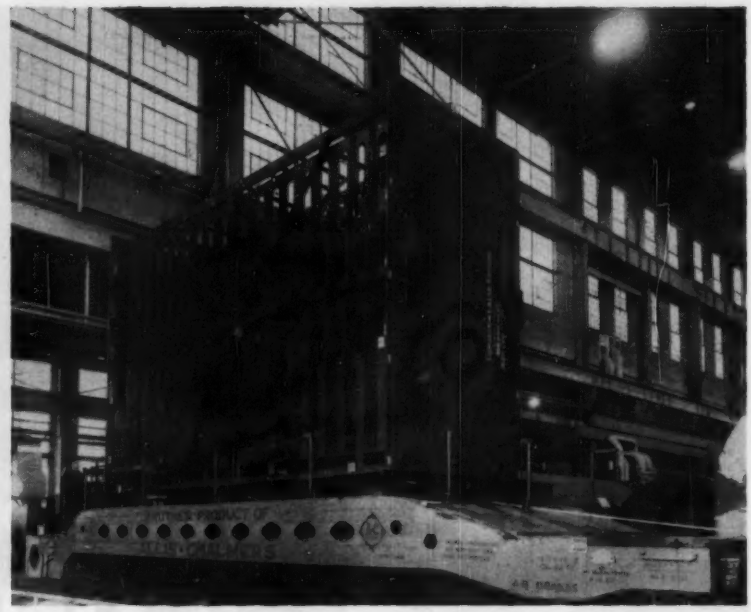
PALNUT Lock Nuts have been used for years on wood poles, steel towers, fittings, connectors, switches, hardware, transformers, etc. Complete range of sizes, in all finishes and materials used by utility industry. Get Bulletin #577.

THE PALNUT COMPANY

51 Glen Road
Mountainside, N. J.




PALNUT
TRADE MARK
LOCK NUTS
for quick, secure fastening at low cost

## A-C Ships 200,000-Sq Ft Condenser

One of the four sections of a 200,000-sq ft condenser is shown leaving Allis-Chalmers Mfg Co's West Allis, Wis., works for Commonwealth Edison's Fisk station in Chicago (EW, Dec. 23, 1957, p 90).

Here's how the transportation was solved: The condenser was routed from Milwaukee to Madison, Wis., to Marquette, Iowa, thence east, south and east again through Illinois. This circuitous route was necessary to obtain the best clearances for these 10 x 17 x 27-ft sections. Five railroads were involved. The condenser had to travel 640 miles to reach its destination less than 100 miles away.

### *M & M BRIEFS*

**Ohio Brass Co,** Mansfield, Ohio, has developed a post-type insulator for 1500-lb cantilever strength. It is designed for economical installation with distribution conductors for voltages up to 25-kv.

**John A. Roebling's Sons Corp,** Trenton, N. J., has a self-supporting aerial spaced cable system featuring plastic clamps. This Roe-clamp is designed for 5- and 8-kv use. Cables are maintained in the same relative position along their entire length and phases may be added or removed. The system may be reinforced without removing the plastic Roe-clamps from the messenger.

**Delta-Star Electric Div,** H. K. Porter Company, Inc, has developed the Powerupter at the higher rating of 34.5 kv. The device, mounted on an MK-40 disconnect switch for interrupting load, magnetizing, and currents, had a former rating of 15 kv. (EW, Nov. 5, 1956, p 56).

**Assembly Products, Inc,** Chesterland, Ohio has developed a profile for its panel meters. The Model 561 has the magnet pole pieces in back of the panel, thus reportedly having a magnetic error of about 1%. The movement, face and pointer are tilted back 6 deg from the vertical front of the meter.

**General Motors,** Delco-Remy Div, Anderson, Ind., has produced its 100 millionth battery. It launched manufacture of automotive batteries with an initial production schedule

of 300 units a day in 1928. Delco's battery business has expanded to a four-plant operation.

**Manning, Maxwell & Moore, Inc,** Industrial Controls Div, has moved its offices and manufacturing facilities from Stratford, Conn. to a new plant in Danbury, Conn. Eugene M. Moore is division general manager.

**H. K. Porter Company, Inc,** New York, has acquired 325,000 shares of Thermoid common stock from the Graham-Paige Corp.

**National Electric Products Corp,** Pittsburgh, Pa., has an improved rigid steel Sherarduct. A coating of protective MVC-1 Vinyl is placed over the galvanized surfaces of the electrical conduit.

**American Institute of Electrical Engineers,** New York, has published four new sections for the dictionary, "American Standards of Electrical Terms." C42: Transportation, land, sea, air, and general.

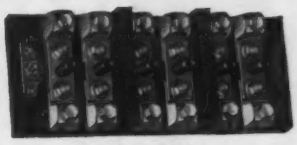
**General Electric Co's** Outdoor Lighting Dept in Hendersonville, N. C., has received a mirror 144 x 100 in. This mirror is the largest made to date by The Falconer Plate Glass Corp, Falconer, N. Y., for use in photometric research and testing.

**Tide Co, Jefferson, Ind.,** has new facilities to handle heavy aluminum fabrication requiring ¼-in. and heavier stock. For some time, a major portion of the company's output has been 120,000-amp aluminum busbars used in high-current electric furnaces. A jig allows welding on two levels.

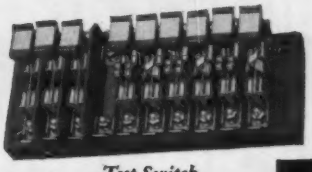
**Highway Trailer Co,** Edgerton, Wis., is shipping to France 12 line construction and maintenance bodies, designed to carry material, equipment and machinery required by power and telephone companies, and 5 earth-boring machines, designed to dig holes from 9 to 20 in. in diam, up to 10 ft deep, in practically any soil.

**Mueller Electric Co, Cleveland, Ohio,** manufacturer of electric clips for test connections, is observing its 50th anniversary.


Look to Superior for
TEST SWITCHES AND BLOCKS



*Test Block*



*Test Switch*

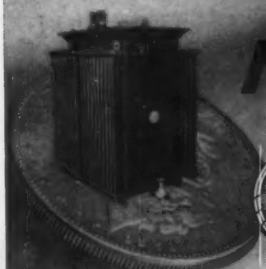
Superior also offers a complete line of
Enclosures
Socket Equipment
Test Tables

SUPERIOR
SWITCHBOARD & DEVICES CO.
CANTON, OHIO
A subsidiary of
The Union Metal Manufacturing Company

Catalog 55 offers complete information on features, services, type and sizes. Write to:

A financial giant, the new Texas National Bank rises on the fabulous Texas Gulf coast. Marcus transformers provide "money in the bank" dependability for power and lighting distribution. For trouble-free performance and greater profits, choose Marcus for your next transformer installation.

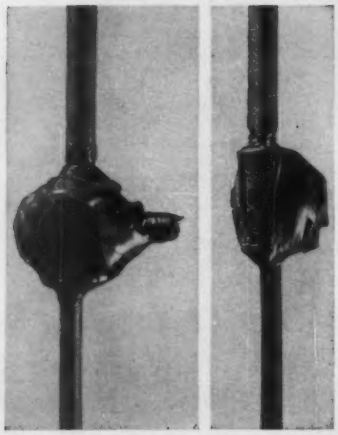
Architect: Kenneth Franzheim, Consulting Engineers: Bernard Johnson & Associates, Electrical Contractor: Howard P. Foley Co.



MARCUS
TRANSFORMER CO., Inc.
RAHWAY, NEW JERSEY
Representatives in Principal Cities
"Mark of Quality"

A COMPLETE LINE OF DRY TYPE AND LIQUID-FILLED TRANSFORMERS THRU 5000 KVA

# New Alcoa 390-490 Series Extruded Parallel-Groove Clamps are More Compact, Easier to Apply



COMPETITIVE CLAMP

ALCOA CLAMP

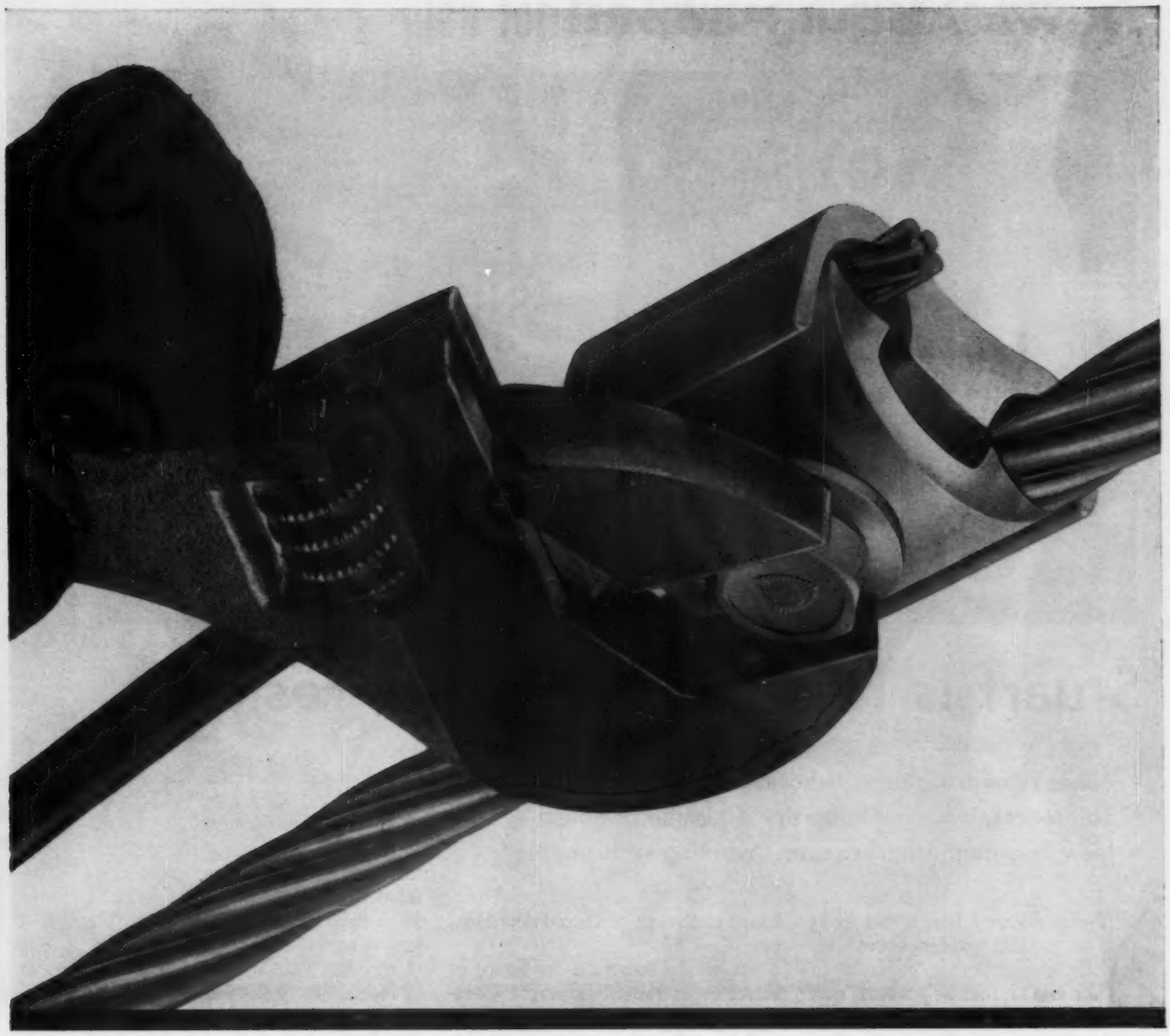
## All loose parts eliminated... reduced bulk gives neater appearance

Now you can get the benefits of Alcoa's universal groove design previously announced for heavy-duty clamps. Two new Alcoa single-bolt, distribution and service-drop-type extruded clamps* accommodate ACSR and stranded aluminum sizes #6 to #2 7/1 (Catalog 490.0) and #6 to 2/0 (Catalog 396.6).

Top and bottom parts of the new clamps are Alcoa® Extrusions —made strong, solid and dense from heat-treated alloy. Grooves are specially treated and coated

*Patent applied for

REDUCED BULK in Alcoa's new 390-490 series clamps makes them easy to tape; gives a neat, more compact appearance on the line, makes them easier to store and handle.



to provide low-resistance surfaces. All parts are aluminum to equalize expansion, eliminate corrosion. The new extended lip prevents cap from turning when being applied.

Other benefits you get with these economical new Alcoa clamps are easier application and handling. Loose parts have been eliminated. These clamps can be applied "hot." Bolts are anodized to reduce thread friction. A supply of these clamps on your trucks will cover most distribution applications. Simplified ordering and stocking, and fast delivery, also save you money.

When you specify Alcoa parallel-groove clamps, you also buy the experience gained during a quarter of a century of manufacturing clamps and other accessories for aluminum . . . plus years of extensive laboratory testing. Ask your Alcoa representative to show you samples of these clamps. Call him today for full information, or write Aluminum Company of America, 2306-C Alcoa Building, Pittsburgh 19, Pennsylvania.

ALCOA ALUMINUM
ELECTRICAL CONDUCTORS AND ACCESSORIES
ALUMINUM COMPANY OF AMERICA

**Your Guide to the Best in Aluminum Value**

"ALCOA THEATRE"
Exciting Adventure.
Alternate Monday Evenings

# News About People

# Stuart Is New Dayton P&L President

- Takes reins from Long, who moves up to chairman slot
- Tait retires, is named honorary chairman of board
- New President Stuart stresses "working with people"

"Twice a year I like to get away and do a little fishing—providing that the fish are not too eager."

Thus Jim (James M.) Stuart, new president of The Dayton Power & Light Co, answered the question: "How do you avoid ulcers?" His other remedies include leaving your troubles in the office, doing a little work around the yard, and reducing tension by working with people, never against them.

Stuart was named president and general manager Feb. 7, succeeding Kenneth C. Long, who moved up to chairman of the board. Frank M. Tait, former board chairman, was named honorary chairman of the board. He will continue to serve on the board as a member.

New Pres Stuart's desire to work with people is accredited by a list of civic contributions a yard long. Right now he is president of the Dayton Boys Club, chairman of the board of directors of the city's Junior Achievement, and associate board chairman of Grandview Hospital.

He served terms on the board of directors of the Chamber of Commerce and the Community Chest, and has taken the responsibility for gifts advanced in the Red Cross and Community Chest drives.

DP&L's new president built his career on a firm foundation of back-breaking labor. During high school vacation, he worked with his father in the coal mines of Coshocton, Ohio. He continued in his efforts to pay for his education as a co-op student at University of Cincinnati.

It led him to a job as a laborer with DP&L in 1923.

Promotion was steady. Steps in his path included: Apprentice substation operator, apprentice electrician, clerk in the line department, assistant supervisor of the underground department, and manager of the electric division. He became vice president Jan. 1, 1947. On Aug. 15, 1948 he was named to the board of directors and made associate general manager.

Stuart's management philosophy is: "I pick the best man I can find and one whom I have great confidence in to do the job. Then I keep encouraging him to do it. He knows he will hear from me if something gets off the track."

He is firmly convinced that the utility industry has done an outstanding job for the country, and that it has a right and obligation to tell the story to the people.

He likes to be called "Jim," but confesses he is already finding some difficulty in maintaining that informality with some associates.

Stuart makes an occasional unannounced tour of company property, and likes to stop and chat with the men on the job. Employees know him. Many of them have helped him along the way and look forward to these chats.

The Stuart family consists of Mrs Stuart, also active in civic work, and three sons ranging from 17 to 32 years of age.

James, Jr, is assistant industrial relations manager of the McCall Corp plant in Dayton. Curtis is an

(*Continued on page* 132)

# plan for the future plan to use RT&E Dual Voltage Transformers NOW!

operate system voltages faster, easier, more economically

You can now look ahead and plan, with complete assurance, a relatively simple and economical way to increase system voltage. The development of the R T & E Dual Voltage Transformer makes this advance planning possible. You save on stocking, since one unit takes the place of two. You save on obsolescence when system voltage is uprated. Save on personnel needed for cut-over work.

Externally operated primary voltage change-over switch means instant voltage change, saving down time and labor time. No tank opening required, no bolted connection changes. No interruption of service; you cut over larger areas faster.

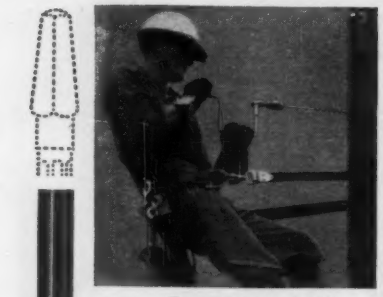
Available with all primary voltage combinations: 2400 x 4800 volts, 2400 x 7200 volts, 7200 x 14,400 volts, 4800 x 14,400 volts. Or custom designed to meet special voltage requirements. Prices for the R T & E Dual Voltage Transformer are only slightly higher than conventional single voltage transformers.

Concentrated Engineering Talent Makes One Product Better

RT&E CORPORATION
PORTLAND, OREGON • WAUKESHA, WISCONSIN

# New adapter shank bit

**fits either hand brace or power drill**



Taper square shank fits hand braces

Cut off taper and use "hex" shank in both power drills and hand braces

***Cut your wood bit inventory by 50%***

Now you can eliminate the need to stock two types of wood auger bits. Irwin's new Adapter Shank Bit fits both hand braces and power drills.

With hand braces, use the Adapter Shank Bit as it comes. Cut off taper square and the Adapter Shank, with its 6 "hex flats", chucks perfectly in power drills or hand braces, either one. No wobble, no run-out. Clean, efficient cutting action. Reduces inventory and record keeping by 50%. Saves time on the job, too. Call your distributor, or write today for complete information. Sizes 4/16" to 17/16", both solid center and single twist types.

***All Irwin Adapter Shank Wood Bits** are forged in one piece from special steel and heat tempered full length for longer life. Plastic coating on balanced cutting heads guarantees factory-fresh sharpness, unequalled performance. Widely used by utilities, electricians and construction workers.*

**IRWIN** auger bits • screw drivers

Wilmington, Ohio


## Stuart

(*Continued from page* 130)

engineer with the United Gas Pipe Line Corp at Shreveport, La. Chuck is a high school senior looking forward to a career as a physicist.

The new president has served in several important posts in the electric industry. They include chairman of the board of directors of the Ohio Valley Utility Institute and member of the board of directors of the Ohio Valley Electric Corp.

Frank M. Tait, retiring as Dayton P&L's active board chairman, is recognized as "dean of the electric industry." He was placed in charge of DP&L in 1904, when the company had 700 customers. Today it has over a million. In addition to his utility interest, Tait heads the Frank M. Tait Foundation and is a nationally-known industrialist. In his early years, he knew and worked with Thomas A. Edison.

Kenneth C. Long, who succeeds Tait as chairman of the board, started his career with DP&L in 1913 as an electrician's helper. He has been president since Jan. 1, 1946. He is a member of the Steering Committee of the East Central Nuclear Group.

## Schuler Is Named Operations VP

Anderson Electric Corp has a new vice president in charge of operations. He is John H. Schuler, former administrative V.P.

Schuler will now supervise manufacturing, purchasing, and personnel at Anderson's Birmingham and Leeds, Ala., plants.


# ATLAS

## INDUSTRIAL SAFETY EQUIPMENT

**security designed for the job . . .**

Safety belts & Straps, Harnesses, Lanyards, Rope Safety Nets and Ladders, Axes insulated for 20,000 Volts

for: Linesmen, painters, electrical, bridge, construction and marine workers, window cleaners and tree surgeons.

Available in leather and web.

All hardware drop forged, tested.

*Write for complete literature on our safety equipment line*

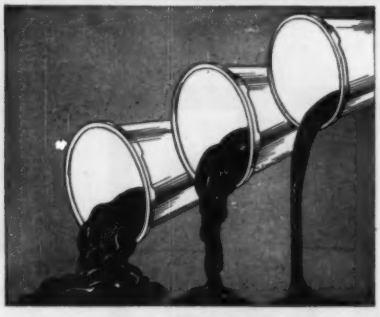
**ATLAS SAFETY EQUIPMENT CO., INC.**

177 N. 10th St. Brooklyn 11, N. Y.

***Insulating and Cable-Pulling***

# COMPOUNDS

***of Record-Breaking Performance***



**Minerallac gives you a complete assortment for every need: dense, viscous and fluid consistencies for high and low voltages in cable-joints, pot-heads, terminal bells, distribution cables, street lighting, telephone work . . . Insoluble in oil or water, for all temperatures. Clean, safe, economical—outranks all others in quality.**

***Send for new literature and prices.***

**MINERALLAC ELECTRIC COMPANY**

**25 North Peoria Street—Chicago 7, Illinois**

# MINERALLAC

## Reed Will Retire As GE Chairman

Philip D. Reed, chairman of the board of the General Electric Co for the past 19 years, will not seek reelection.

He will continue to serve as chairman until after the annual GE share owners meeting April 23, 1958. At that meeting he will seek the chairmanship of the Finance Committee, to serve in that capacity and act as a consultant until his planned retirement in 1959.

Said Reed: "For many years I have planned to retire from active service with General Electric Co at age sixty which I shall reach next year."

Speaking for the company, GE Pres Ralph J. Cordiner expressed regret at Reed's approaching retirement, but said GE recognized and respected Reed's long-standing personal plan.

"Fortunately," Cordiner added, We will continue to have the benefits of his counsel for some time."

### *PERSONAL BRIEFS*

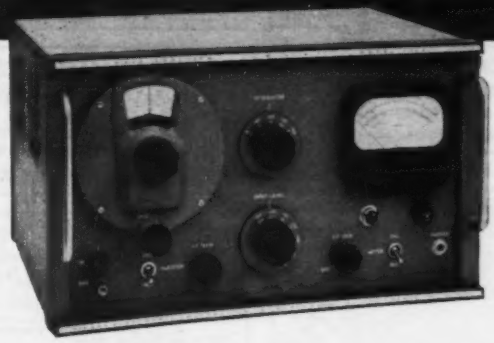
Electric Department, Public Service Electric & Gas Co, has moved **George F. Wolf** up to assistant to the general superintendent of electric distribution. **Paul H. Nelson** replaces him as division superintendent, Bergen Division, electric distribution department. **Charles W. Cornforth** has been named assistant industrial relations manager. **Edward G. Outlaw** became division superintendent, Bergen electric distribution department.

(*More Briefs on page* 135)


Fast, convenient, dependable

**precision wave analyzers**

for wave analysis, wire carrier and microwave subcarrier measurements



**Sierra 121A Wave Analyzer** is a double superheterodyne receiver covering 15 KC to 500 KC. It provides data directly in volts and dbm at 600 ohms, and offers high selectivity required for single sideband carrier measurements.

**Sierra 158A Wave Analyzer** is similar to Model 121A but covers 500 KC to 10 MC.

Both instruments have ±2 db accuracy, spurious response at least 50 db down, and signal measurement range of 77.5 μv to 97.5 volts. Available for either cabinet or relay rack mounting.

**Frequency-selective carrier-frequency voltmeters**

For carrier frequency and other field or laboratory work between 3 KC and 800 KC, Sierra offers five accurate, stable tuned vacuum tube voltmeters. All are direct reading in voltage and dbm at 600 ohms from —80 dbm to +42 dbm. All feature built-in calibration oscillators, level calibration circuits, aural monitoring jacks, and (except 103B) precision spiral scale dials. All are ruggedly constructed of quality components for long operating dependability.

**SPECIFICATIONS — SIERRA VOLTMETERS**

| Model | Frequency Range—kc | Selectivity | | Accuracy | | Direct Reading in dbm | |
|---|---|---|---|---|---|---|---|
| | | Down 3db | Down 45db | Frequency | Measuring | Balanced | Unbalanced |
| 101C | 20-500 | ± 550 cps | ± 2900 cps | Note A | ± 3 db | Note D | 600 ohms |
| 103B† | 3- 40 | ± 400 cps | ± 3000 cps | ± 0.5 kc | ± 3 db | Note D | 600 ohms |
| 104A | 5-150 | ± 300 cps | ± 1500 cps | ± 1 kc | ± 3 db | Note D | 600 ohms |
| 108B | 15-500 | ± 550 cps | ± 2900 cps | ± 3 kc Note B | ± 2 db Note C | 135 ohms Note D | 600 ohms |
| 114A | 100-800 | ± 550 cps | ± 2900 cps | Note A | ± 3 db | Note D | 600 ohms |

† Contains carrier re-insertion oscillator for monitoring suppressed carrier systems. Furnished with planetary drive dial. Note A. Ranges from ± 2 KC at low end of dial to ± 3 KC at upper end. Note B. ± 1 KC in the 48 KC to 256 KC region. Note C. ± 1 db for + 30 db to —40 db attenuator steps on 135 ohm balanced measurements. Note D. All models may be converted for 135 and 600 ohm balanced line measurements by convenient plug-in bridging transformer, Model 130D.

Data subject to change without notice.

**Sierra Electronic Corporation**

*A Subsidiary of Philco Corporation*

4694W Bohannon Drive • DAvenport 6-2060

Menlo Park, California, U.S.A.

Sales representatives in Major Cities

Canada: Atlas Radio Corporation, Ltd., Toronto, Montreal, Vancouver, Winnipeg

Export: Frazar & Hansen, Ltd., San Francisco, New York, Los Angeles

# PROFESSIONAL SERVICES

## AMERICAN AIR SURVEYS, INC.

- Aerial Topographic Maps & Photos
- Plan & Profile for Transmission Lines
- Aerial Stereo-photos for Planning
- Topographic Maps for Reservoir Studies
- Coal Stockpile Volumes by Aerial Method

907 Penn Avenue. Pittsburgh 22, Pa.

## BARKER & WHEELER

Utility and Industrial Valuations, Design and Construction of Power Systems, Water Supplies, Sewerage and Sewage Disposal, Factory Production and Cost Control Systems.

11 Park Place, New York City
36 State Street, Albany, N. Y.

## BLACK & VEATCH

*Consulting Engineers*

Electricity—Water—Sewage—Industry

Reports, Design, Supervision of Construction
Investigations, Valuations and Rates

1500 Meadow Lake Parkway Kansas City 14, Mo.

## BROOKLYN ENGINEERING CORP.

*Utilities Erectors & Consultants*

Baltimore 26, Md.

Power Plant equipment erection, mechanical and electrical construction from manufacturers and engineers drawings. Supervision by general power engineering staff for heat cycle coordination. Improvements—Modifications—etc.

## THEODORE D. BROSS LINE CONSTRUCTION CORP.

Steel Tower & Wood
Transmission Lines

*Distribution & Maintenance*

175 Enfield St. Hartford, Conn.

## BURNS and ROE, Inc.

Engineering and Design • Reports • Surveys
Construction • Electric, Steam, Hydro Plants
Transmission • Distribution • Aeronautical
Facilities • Research and Development • Nuclear, Chemical, and Industrial Plants

160 West Broadway • New York 13, N. Y.

## COMMONWEALTH SERVICES INC.

Management and
Business Consultants
300 Park Ave
New York 22, N. Y.

## ASSOCIATES INC.

Consulting and Design
Engineers
309 E. Washington
Jackson, Michigan

## DAY & ZIMMERMANN, INC.

*Engineers*

Design—Construction
Transmission—Distribution Lines
Reports—Valuations—Rates

New York PHILADELPHIA Chicago

## DOBLE ENGINEERING COMPANY

*Electrical Insulation Engineers*

Field Testing and Maintenance of High Tension Insulation, Special Problems in Electrical Communications

Office and Laboratory: Doble Park
Box 344, Belmont 78, Mass. (6 miles from Boston)
Branch Office: 30 N. Wacker Dr., Chicago, Ill.

## ELECTRICAL TESTING LABORATORIES, INC.

2 East End Ave. New York 21, N. Y.

Electrical, Electronic, Environmental, Photometric and Chemical Laboratories. Testing, Research, Inspection and Certification.

## FORD, BACON & DAVIS

*Engineers*

DESIGN • CONSTRUCTION
VALUATIONS • REPORTS

New York • Chicago • Los Angeles

## GILBERT ASSOCIATES, INC.

*Engineers and Consultants*

DESIGN
SUPERVISION OF CONSTRUCTION
BUSINESS AND ECONOMIC RESEARCH

Reading, Pa. New York, N. Y.

## HARZA ENGINEERING CO.

*Consulting Engineers*

Calvin V. Davis E. Montford Fucik
Richard D. Harza
Hydroelectric Plants and Dams
Transmission Lines
Flood Control, Irrigation
River Basin Development

400 West Madison Street Chicago 6

## HOOSIER ENGINEERING COMPANY

*Erection and Maintenance of Electrical Transmission and Distribution Lines*

1350 Holly Ave., Columbus 16, Ohio

## JACKSON & MORELAND, INC.

*Engineers and Consultants*

Design and Supervision of Construction
Reports—Examinations—Appraisals
Machine Design—Technical Publications

Boston New York

## JENSEN, BOWEN & FARRELL

*Engineers*

Appraisals—Investigations—Depreciation Studies—
Cost Trends—Reports
for Rate Cases, Security Issues, Regulatory and Accounting Requirements
Original Cost and Continuing Property Record Determination
Ann Arbor, Michigan

## THE KULJIAN CORPORATION

*Engineers - Constructors - Consultants*

POWER PLANT SPECIALISTS
(Steam, Hydro, Diesel)
Utility • Industrial • Chemical

1200 N. Broad St., Philadelphia 21, Pa.

## PETER F. LOFTUS CORPORATION

*Design and Consulting Engineers*

Electrical • Mechanical • Structural
Civil • Nuclear • Architectural

First National Bank Building
Pittsburgh 22, Pennsylvania

## CHAS. T. MAIN, INC.

*Engineers*

Electric, Steam and Hydraulic Projects,
Investigations, Reports, Appraisals
Design and Construction Supervision

Boston, Mass. Charlotte, N. C.

## PIONEER SERVICE & ENGINEERING CO.

Consulting and Design
Engineers . . Purchasing
Specialists in Financing
Accounting and other Operations

231 So. La Salle St. Chicago 4

## SANDERSON & PORTER ENGINEERS

Design
Construction

New York New York

## SARGENT & LUNDY

*Engineers*

140 South Dearborn St.

Chicago, Ill.

## SVERDRUP & PARCEL, INC.

*Engineers - Architects*

Design, Construction Supervision
Steam and Hydro Power Plants
Power Systems - Industrial Plants
Studies - Reports

St. Louis San Francisco Washington

## TIPPETT & GEE

*Consulting Engineers*

Mechanical • Electrical • Thermodynamic
Structural Design • Studies • Supervision

Power Stations • Transmission • Distribution
Industrial Plants • Process

1323 North Second Street Abilene, Texas

## TREE PRESERVATION CO. Inc.,

Transmission R/W Clearing
Chemical Brush Control
Utility Tree Trimming
Seeding

Elmsford New York
Tel: LY 2-7800 - 2-7801 - 2-7802

## F. A. TUCKER, INC.

*Contractors—Engineers*

specialize in
Distribution - Transmission - Telephone lines - Maintenance - Roads - Bridges Dams

Main Office — 38½ Center Street, Rutland, Vt.
Branch Office — Little Rock Road, Charlotte, N. C.

## UTILITIES LINE CONSTRUCTION COMPANY, INC.

*Construction and Maintenance*

Transmission - Distribution
Electric and Telephone Lines
Consultants

505 York Road Jenkintown, Pa.

## WALTER von TRESCKOW

FINANCIAL
AND ECONOMIC CONSULTANTS

400 E. 52nd Street New York 22, N. Y.

## THE J. G. WHITE ENGINEERING CORPORATION

Design • Construction • Reports • Appraisals

80 Broad Street, New York 4

# SEARCHLIGHT SECTION


## MANUFACTURERS' REPRESENTATIVE

**Cincinnati Trade Area**

**Leading manufacturer of electrical fittings for utility distribution systems looking for aggressive agency covering Cincinnati-Dayton-Louisville area with proven record selling utilities and electrical wholesalers.**

***Reply in confidence to***

**RW-7242,** Electrical World
520 N. Michigan Ave., Chicago 11, Ill.

## DIRECT BURIAL CABLE

**1,250,000 ft**
**#6 AWG, 7 strands on 2,000 ft reels**

**70,000 ft**
**#1 AWG, 19 strands on reels, random length**

***SAMPLES UPON REQUEST***

**HUGO NEU CORPORATION**
**45 Nassau Street** **New York 5, N. Y.**

## RIGHT-OF-WAY AGENT

**Experienced in transmission line right-of-way work, public utility background preferred. Location, eastern United States with growing and progressive electric utility. Write**

**P-7417,** Electrical World
Class. Adv. Div., P.O. Box 12, N.Y. 36, N.Y.


### U. S. Government

DEPARTMENT OF THE INTERIOR, Bureau of Reclamation. Sealed bids (Invitation No. DS-5024) will be received at Denver, Colorado, until March 20, 1958, for furnishing two (2), 230-kv, 1,200-amp, 5,000,000-kva, 3-cycle interruption power circuit breakers; and two (2) 14.4-kv, 2,000-amp, 1,500,000-kva, 3-cycle interruption power circuit breakers for Fargo Substation, Missouri River Basin Project, North Dakota. Delivery is desired within 390 days. For particulars, address Bureau of Reclamation, Building 53, Denver Federal Center, Denver 2, Colorado. W. A. Dexheimer, Commissioner.


**LARGE POWER EQUIPMENT**
***Prompt Stock Shipment***
**REBUILT MOTORS - GENERATORS**
**TRANSFORMERS - CIRCUIT BREAKERS**
***DO YOU GET OUR STOCK LIST?***
**BELYEA COMPANY, INC.**
**51 Howell St.** **Jersey City, N. J.**
**DL 3-3334**


## Personal Briefs

(*Continued from page* 133)

**L. E. Didier** has been named assistant secretary of Louisiana Power & Light Co . . . Cincinnati Gas & Electric Co has appointed **George H. Day** as manager of the company's Eastern Division.

**Donald E. Hughes** has been appointed chief engineer of the Cowlitz County Public Utility District at Longview, Wash., succeeding **R. J. Pangborn,** resigned . . . Oklahoma Gas & Electric Co's **Robert W. Baze** has moved into the chief engineers spot at Osage Station in Ponca City, succeeding George Bishop, retired.

Joslyn Mfg & Supply Co has advanced **M. C. Zwang** to assistant sales manager of the Central Division, with headquarters in Chicago.

## OBITUARY

**Dr Adam S. Bennion,** 71, retired vice president of Utah Power & Light Co, died recently in Salt Lake City.

*ADDRESS BOX NO. REPLIES TO: Box No.*
*Classified Adv. Div of this publication.*
*Send to office nearest you.*
*NEW YORK 36: P. O. BOX 12*
*CHICAGO 11: 520 N. Michigan Ave.*
*SAN FRANCISCO 4: 68 Post St.*

### POSITION VACANT

**Operations Analyst-for diversified utility firm** in Fairfield County, Connecticut. Must be engineering graduate with utility operating experience and some knowledge of utility accounting. Work directly under direction of Vice President on analysis of property operations. Submit complete resume and salary desired P-7418, Electrical World.

### EMPLOYMENT SERVICE

**Salaried Personnel $5,000-$30,000.** This nationwide service successful since 1927 finds openings in your fields. Sells your abilities; arranges contacts. Present position protected. Write for details—Jira Thayer Jennings, P. O. Box 674, Manchester, Vermont.

***Your Inquiries to Advertisers Will Have Special Value . . .***

**—for you—the advertiser—and the publisher, if you mention this publication. Advertisers value highly this evidence of the publication you read. Satisfied advertisers enable the publisher to secure more advertisers and — more advertisers mean more information on more products or better service — more value—to YOU.**


COMING APRIL 1958

INSULDUR®

Major Breakthrough for Distribution Transformers J-70839

YOU CAN BE SURE...IF IT'S Westinghouse

# Readers Forum

## Play Safe on Reclosers

I noted in "EXECUTIVE READER" of the Jan. 6 issue a comment concerning maintenance of reclosers.

When I first read this I became quite concerned that this could be interpreted into a recommendation that unless excessive failures were occurring on reclosers maintenance could not be justified. To this I can not agree.

The industry standards while conservative, recommend maintenance of reclosers every year or every hundred operations. We are involved here in a safety hazard which can not be ignored. As you may know, there have been a number of people injured, some fatally, through the operation of a recloser failing under fault conditions. In many cases this has been directly attributed to lack of maintenance on the device.

Application of reclosers is mainly to replace oil circuit breakers and relays at a cost of $200.-$300. dollars. They are automatic so that once installed it is impossible for a lineman to tell how many operations a device has had since its last maintenance unless records are kept on the difference in readings on the counter. The common and practical procedure of closing a recloser to test the line to see if the fault has cleared places the lineman beneath the recloser when it is called upon to perform its most severe kind of duty, closing in on a fault.

I think we should in no way encourage utilities to adopt the policy which may subject their people to hazardous conditions. It is obvious that if the recloser is left alone until it finally fails . . . which is generally by blowing up . . . it is very possible that personnel will be operating the recloser at this particular time.

F. E. Reiber, Sales Manager
Distribution Apparatus Department
Westinghouse Electric Corp.
East Pittsburgh, Pa.

## Likes Meter Cover

To the Editor:

All of us at Sangamo are delighted with the cover treatment which you have given our Type AD-6 meter as installed in a vault of the Commonwealth Edison Co. We are also very pleased with the article on page 70 and 71 on "How to Improve Your Network Load Metering."

Robert R. Wylie
Marketing Manager
Sangamo Electric Co
Springfield, Ill.

## Praise for Perforations

To the Editor:

Don't worry about permanent binding of Electrical World—this is a problem that can be overcome.

The perforated pages in your magazine are the greatest invention since the wheel.

A. Y. Taylor
Project Manager
Jackson & Moreland, Inc.
Boston 16, Mass.

Next week's issue of Electrical World will carry stories on the first U. S. commercial-scale atomic power plant soon to be dedicated at Shippingport, Pa. You'll learn why this plant can be operated in some respects as a conventional plant. Pictures round out the coverage.

# Advertising Index


Allis-Chalmers Mfg. Co. ..... 6, 7
Aluminum Co. of America ..... 128, 129
American Chain & Cable Co., Inc.
Page Fence Ass'n ..... 95
Anaconda Wire & Cable Co. ..... 32, 33
Anchor Metals, Inc. ..... 41
Atlas Safety Equipment Co. ..... 132
Atomics International Div.
North American Aviation, Inc. ..... 56

Babcock & Wilcox Co. ..... 34, 35
Baldwin-Lima-Hamilton Corp.
Eddystone Div. ..... 42
Bell Telephone Laboratories ..... 27
Blackburn Corp., Jasper ..... 28

C&D Batteries, Inc. ..... 96
Chance Co., A. B. ..... 117, 118, 119, 120
Combustion Engineering, Inc. ..... 50
Condenser Service & Engineering Co., Inc. ..... 112

Delta-Star Electric Division, H. K. Porter Company, Inc. ..... 123, 125
Diamond Power Specialty Corp. ..... 97
Directory of Engineers ..... 134
Dow Chemical Co. ..... 52, 53
Dowell Incorporated ..... 16
du Pont de Nemours & Co (Inc.)
Elastomer Chemicals Dept. ..... 43, 44, 45, 46

Eddystone Div., Baldwin-Lima-Hamilton Corp. ..... 42
Electrical Engineers Equipment Co. ..... 12
Engineers, Directory of ..... 134
Everstick Anchor Co. ..... 102

Exide Industrial Div., The Electric Storage Battery Co. ..... 3rd Cover

G&W Electric Specialty Co. ..... 98, 99
General Electric Co.
Apparatus Dept. ..... 83, 84, 85, 86, 87, 88, 90, 91, 92, 93, 95
Goodrich Chemical Co., B. F. ..... 15
Gulf Oil Corp. ..... 105, 106, 107, 108

I-T-E Circuit Breaker Co.
Switchgear Div. ..... 29
Irwin Auger Bit Co. ..... 132

Joslyn Mfg. & Supply Co. ..... 57

KPF Electric Co. ..... 39
Kaiser Engineers Div.,
Henry J. Kaiser Co. ..... 14
Kerite Company, The ..... 62
Kuhlman Electric Co. ..... 4th Cover

Lapp Insulator Co., Inc. ..... 54, 55
Leeds & Northrup Co. ..... 8
Line Material Industries ..... 9, 10, 11

Marcus Transformer Co., Inc. ..... 127
Mineralac Electric Co. ..... 132
Minneapolis-Honeywell Regulator Co.
Industrial Div. ..... 58, 59
Moloney Electric Co. ..... 48, 49

Ohio Brass Co. ..... 23, 24, 25, 26
Okonite Company ..... 4
Onan & Sons Inc., D. W. ..... 122

Page Fence Ass'n, American Chain & Cable Co., Inc. ..... 95
Palnut Company ..... 126
Pennsylvania Transformer Div., McGraw-Edison Co. ..... 13, 101

RT&E Corp. ..... 131
Radio Corp. of America ..... 60, 61

S&C Electric Co. ..... 18
Sangamo Electric Co. ..... 17
Searchlight Section ..... 135
Sierra Electronic Corp. ..... 133
Superior Switchboard & Devices Co. ..... 127

Texas Company, The ..... 2nd Cover
Thomas & Betts Co., Inc. ..... 94
Tobe Deutschmann Corp. ..... 47

United States Steel Corp., Coal Chemical Sales Div. ..... 37

Victor Insulators Div.
I-T-E Circuit Breaker Co., Inc. ..... 103

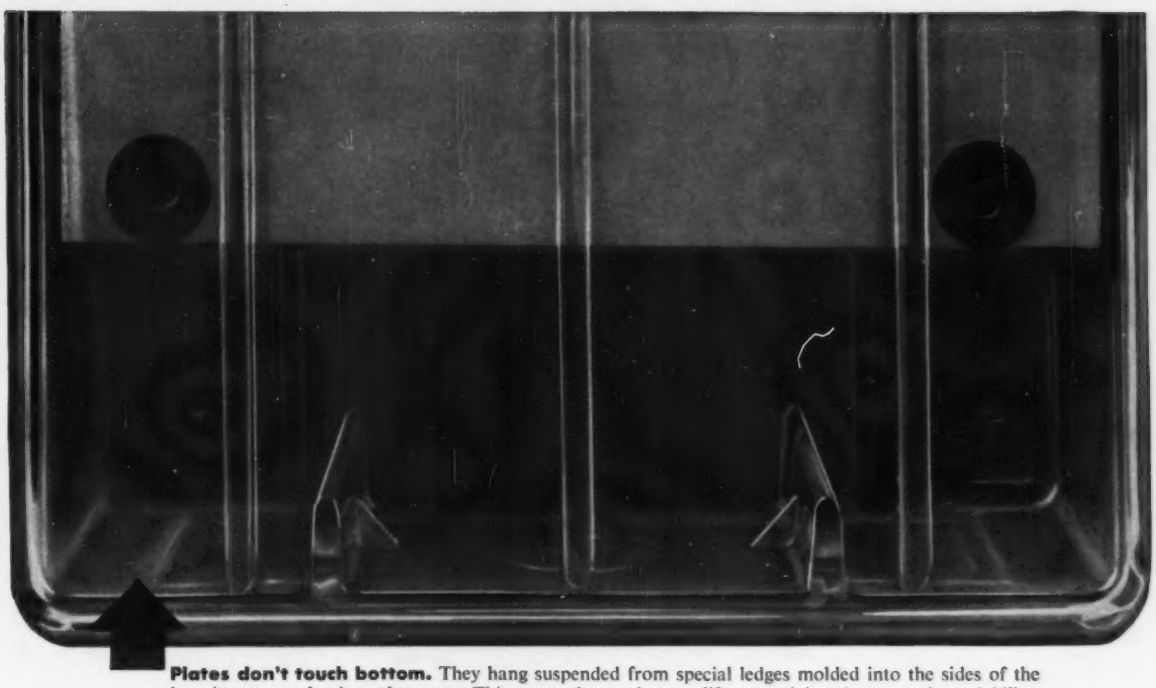
Wagner Electric Corp. ..... 38
Westinghouse Electric Corp. ..... 30, 31, 40, 51, 110, 111, 135
Westinghouse Electric Corp.
Sturtevant Div. ..... 36

PROFESSIONAL SERVICES ..... 134

CLASSIFIED ADVERTISING
F. J. Eberle, Business Mgr.

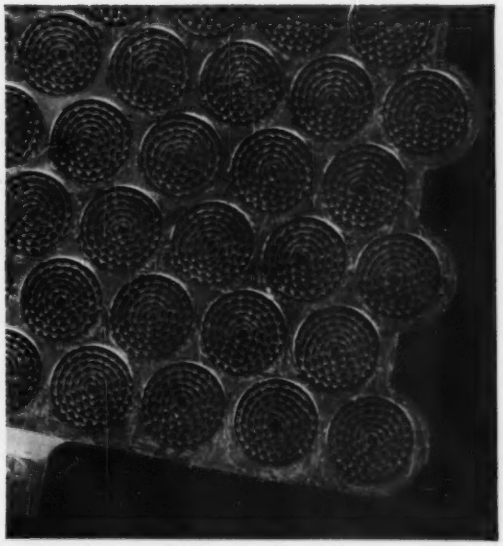
EMPLOYMENT OPPORTUNITIES ..... 135

EQUIPMENT
(Used or Surplus New)
For Sale ..... 135



**Plates don't touch bottom.** They hang suspended from special ledges molded into the sides of the jar—impose no load on the cover. This means longer battery life potential and greater dependability.

# NEW EXIDE-MANCHEX BATTERY ...BUILT FOR EXTRA LIFE



**Exide-Manchex positive plate.** Active material is built up between the spiral layers of these unique lead buttons that act like tiny shelves. Support it against shedding. Reserve lead prolongs battery life.

In the new Exide-Manchex, plates are suspended from the top—do not touch the bottom of the jar at all. So sediment drops right to the bottom, inches away from the plates. It will never, never cause a short.

This new design feature means that Exide-Manchex now has longer life potential than ever. In addition, the new open design spacer, with high porosity, microporous separator, means lower internal resistance and higher capacity. Greater electrolyte reserve means less frequent watering and assures better voltage.

Get complete information on this stationary battery, the finest you can buy. Write Exide Industrial Division, The Electric Storage Battery Company, Philadelphia 2, Pa.

Exide®

## HOUSEPOWER HIGHSPOTS

# "If you can't lick 'em, join 'em!"

***decided Cincinnati Gas and Electric, so they pioneered Wire-on-Time plan that has financed $1,673,185 in Cincinnati HOUSEPOWER rewiring jobs***

*Customer applies to the utility for financing through the Wire-on-Time plan. After rewiring job is completed, the utility will pay the contractor in full, bill the customer in small amounts.*

*Contractors modernize customer's wiring so that his electrical appliances work properly. Low monthly payments make it easy for contractor to sell complete HOUSEPOWER job.*

Inadequate wiring, in a majority of homes served, was blocking growth of residential electric load in Cincinnati. People bought all sorts of things on time credit plans, but bought rewiring—requiring large chunks of cash—hardly at all.

"Why not sell rewiring jobs on time, too?" the utility wondered. Soon it originated its revolutionary Wire-on-Time program for residential customers—no down payment, up to 36 months to pay, small monthly payments added to the electric bill. Later, the plan was broadened to include commercial property and to allow 60 months for repayment. Extensive advertising and promotional activities backed up the new plan.

Results were phenomenal! To date, the utility has financed 5,336 rewiring jobs for a total contract value of $1,673,185, with 583 contractors participating. Each year, more HOUSEPOWER jobs are being sold, and the average cost per job has risen, too!

Cincinnati Gas & Electric's Wire-on-Time program has been so successful that about 40 utilities have adopted similar programs.

*"A fresh approach, such as this to HOUSEPOWER sales, can bring astonishing results—results that benefit all in the electrical industry," says J. H. Watkins, Vice President and Manager of the Transformer Division, Kuhlman Electric Co.*

*Published in the interest of the electrical industry by*

**KUHLMAN ELECTRIC COMPANY**
Birmingham, Michigan

MANUFACTURERS OF DISTRIBUTION AND POWER TRANSFORMERS